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TRANSACTIONS

OF THE

OPHTHALMOLOGICAL SOCIETY

OF THE

UNITED KINGDOM

WITH WHICH ARE AFFILIATED THE

EGYPTIAN OPHTHALMOLOGICAL SOCIETY
MIDLAND OPHTHALMOLOGICAL SOCIETY
NORTH OF ENGLAND OPHTHALMOLOGICAL SOCIETY
OXFORD OPHTHALMOLOGICAL CONGRESS

VOL. XXXVIII

SESSION 1918

WITH

LIST OF OFFICERS, MEMBERS, ETC.

LONDON
J. & A. CHURCHILL
7, GREAT MARLBOROUGH STREET

1918

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ADLARD AND SON AND WEST NEWMAN, LTD., IMPR., LONDON AND DORKING.

IN EXCHANGE.

American Journal of Ophthalmology.
Annales d'Oculistique.
Annali di Ottalmologia.
Annals of Ophthalmology.
Archiv für Ophthalmologie.
Archives d'Ophtalmologie.
Archives of Ophthalmology.
Bulletin de la Société française d'ophtalmologie.
Ophthalmic Record, Chicago.
Ophthalmology.
Revue générale d'Ophtalmologie.
Transactions of the American Ophthalmological Society.

NOTICE.

The present volume comprises the proceedings of the Ophthalmological Society of the United Kingdom during its Thirty-eighth Session, May, 1918.

The Society does not hold itself responsible for the statements, reasonings, or opinions expressed in the communications which the Council has deemed suitable for publication.

TABLE OF CONTENTS

OF VOLUME XXXVIII.

	PAGE
Officers and Council	IX
List of Presidents	X
List of Members	XI
Rules	XXXIV
List of Communications made during the Session	XLI
List of Plates	XLV
List of Diagrams, etc., in Text	XLVI
Communications	1
Appendix and Museum Specimens	285
Report of Council	286
Balance Sheet	288
Oxford Ophthalmological Congress, 1918	289
Midland Ophthalmological Society, 1917–18	363
Index	377

OFFICERS AND COUNCIL

OF THE

Ophthalmological Society of the United Kingdom

ELECTED AT

THE ANNUAL GENERAL MEETING, MAY 2ND, 1918.

President.

J. B. STORY, M.B.

Vice-Presidents.

E. TREACHER COLLINS.

W. G. SYM, M.D. (Edinburgh).

J. H. FISHER.

W. T. LISTER, C.M.G.

Treasurer.

ARNOLD LAWSON.

Council.

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R. R. CRUISE.

J. F. CUNNINGHAM.

S. A. K. WILSON, M.D.

A. B. CRIDLAND (Wolverhampton).

J. G. CLEGG, M.D. (Manchester).

Secretaries.

M. S. MAYOU (*Congress Business, Transactions, etc.*).

R. R. JAMES (*Council Business, List of Members, etc.*)

PRESIDENTS OF THE SOCIETY
(FROM ITS FORMATION).

ELECTED	
1880	SIR WILLIAM BOWMAN, Bart., LL.D., F.R.S.
1883	SIR JONATHAN HUTCHINSON, F.R.S.
1886	JOHN WHITAKER HULKE, F.R.S.
1889	JOHN HUGHLINGS JACKSON, M.D., LL.D., F.R.S.
1890	HENRY POWER.
1893	D. ARGYLL ROBERTSON, M.D.
1895	EDWARD NETTLESHIP, F.R.S.
1897	SIR HENRY R. SWANZY.
1899	SIR ANDERSON CRITCHETT, Bart., C.V.O.
1901	DAVID LITTLE, M.D.
1903	SIR JOHN TWEEDY, LL.D.
1905	PRIESTLEY SMITH.
1907	MARCUS GUNN.
1909	SIR GEORGE BERRY, M.B., LL.D.
1911	J. B. LAWFORD.
1913	F. RICHARDSON CROSS.
1915	W. H. H. JESSOP.
1917	E. TREACHER COLLINS.

TRUSTEES FOR THE SOCIETY.

J. B. LAWFORD.
SIR SEYMOUR J. SHARKEY, M.D.
W. T. HOLMES SPICER.
J. HERBERT PARSONS.
S. A. KINNIER WILSON, M.D.

TRUSTEES OF THE NETTLESHIP PRIZE FUND.

J. B. LAWFORD.
J. H. PARSONS.
W. T. HOLMES SPICER.
S. A. KINNIER WILSON, M.D.

BOWMAN LECTURERS.

ELECTED	
1884	SIR JONATHAN HUTCHINSON, F.R.S.
1885	J. HUGHLINGS JACKSON, M.D., LL.D., F.R.S.
1886	PROF. ZEHENDER (Rostock).
1887	HENRY POWER.
1888	SIR HENRY R. SWANZY.
1889	PROF. HANSEN GRUT (Copenhagen).
1890	J. W. HULKE, F.R.S.
1892	PROF. LEBER (Heidelberg).
1893	T. PRIDGIN TEALE, F.R.S.
1895	SIR W. R GOWERS, M.D., F.R.S.
1896	PROF. SNELLEN (Utrecht).
1898	PRIESTLEY SMITH.
1900	R. MARCUS GUNN.
1902	PROF. E. FUCHS (Vienna).
1904	F. W. MOTT, M.D., F.R.S.
1907	PROF. SATTLER (Leipzig).
1909	EDWARD NETTLESHIP, F.R.S.
1911	E. LANDOLT, M.D. (Paris).
1914	PROF. W. UHTHOFF (Breslau).
1917	SIR GEORGE BERRY, M.B., LL.D.

EDWARD NETTLESHIP PRIZE.

1904	PRIESTLEY SMITH.
1907	JOHN HERBERT PARSONS.
1909	EDWARD NETTLESHIP.
1912	GEORGE COATS.
1915	EDWARD TREACHER COLLINS.
1918	GORDON M. HOLMES, C.M.G., M.D.

*** *Members are requested to communicate with the Council's Secretary when corrections are necessary.*

LIST OF MEMBERS OF THE SOCIETY.

Honorary Members.

Professor Fuchs, Vienna.
Professor Sattler, Leipzig.
Thomas Buzzard, M.D., 74, Grosvenor Street, W.
E. Landolt, M.D., Paris.
Professor Gullstrand, Upsala, Sweden.

EXPLANATION OF ABBREVIATIONS.

O.M.—Original Member.
Pres.—President.
V.-P.—Vice-President.
T.—Treasurer.
L.—Librarian.
S.—Secretary.
C.—Member of Council.
*.—Denotes Resident Life Members.
†.—Denotes Non-Resident Life Members.

GENERAL LIST OF MEMBERS.

ELECTED

1905 Adams, P. E. H., M.B., 53, Broad Street, Oxford.
1912 Alexander, G. F., M.B., 35, Prince of Wales Terrace, Scarborough.
1907 Allport, Wilfred, M.B., 133, Edmund Street, Birmingham.
1899 †Amenabar, Daniel, Casiila 699, Santiago, Chili.
1910 Angelucci, Prof., 2, Piazza N. Amore, Naples.
1913 Anklesaria, M. Dhanjishaw, Ahmedabad, India.
1891 †Armstrong, Hugh, Tamworth, New South Wales.
1895 Attlee, John, M.D., 65, Grosvenor Street, W.

ELECTED

1903 Ballantyne, A. J., M.D., 11, Sandyford Place, Glasgow. (C. 1914–17.)

1907 Bardsley, Percy C., M.B., 67, Wimpole St., W.

O.M. *Barlow, Sir Thomas, Bart., K.C.V.O., M.D., 10, Wimpole Street, W. (C. 1880-81. V.-P. 1894-7.)

1889 †Barrett, James W., M.D., 34, Collins Street, East Melbourne, Australia.

1917 Barrie, T. Stewart, M.B., 23, Glanville Street West, Glasgow.

1883 Barton, J. Kingston, 14, Ashburn Place, Courtfield Road, S.W.

1892 Batten, Rayner D., M.D., 9, Wimpole Street, W. (C. 1905-8.)

1888 *Beaumont, W. M., 4, Gay Street, Bath. (V.P. 1912–15. C. 1901-4.)

1912 Beedham, Henry Wm., M.B., 15, Crediton Hill, West Hampstead, N.W.

1909 Bell, T. Herbert, 801, Boyd Buildings, Winnipeg, Canada.

1891 †Bennett, Alfred H., 16, North Terrace, Adelaide, South Australia.

1897 Bennett, H. Percy, M.B., 12, Victoria Square, Newcastle-on-Tyne.

1905 Bennett, F. D., M.D., 18, Saville Row, W.

O.M. Berry, Sir George A., LL.D., M.B., 31, Drumsheugh Gardens, Edinburgh. (*Pres.* 1909-11. C. 1889-92. V.-P. 1895-8. 1912.)

1899 Bickerton, R. E., D.S.O., M.B., 137, Harley Street, W.

1881 *Bickerton, T. H., 88, Rodney Street, Liverpool. (C. 1895-8. V.-P. 1910-12.)

1905 Bird, J. W., D.S.O., 15, Downside Crescent, Hampstead, N.W.

1892 Black, John Wilson, M.D., 46, Academy Street, Inverness.

1898 Blair, Charles Samuel, M.D., 14, Welbeck Street, W.

ELECTED

1917 Bodkin, Herbert, c/o Capital and Counties Bank, Chelmsford.

1895 †Bonar, Thomson, M.D., Elm Lodge, Staplegrove, Taunton, Somerset.

1907 Bond, C. Shaw, M.B., Liphook, Hants.

1911 Boucher, R. B., M.D., Vancouver, B.C.

1885 Bower, Ernest Dykes, M.D., Elton House, Gloucester.

1897 Bower, John A., M.B., 18, Royal Crescent, Cheltenham.

1905 Brailey, A. R., 11, Old Burlington Street, W.

1902 *Brailey, Wm. Herbert, M.D., 21, Lansdowne Place, Hove, Sussex.

1911 Brearley, E. A., M.B., University Club, Sydney, N.S.W.

1911 Brennard, H. T. W., University Club, Sydney, N.S.W.

1899 Brewerton, Elmore, 73, Harley Street, W. (C. 1909–10; 1914–17. S. 1910-13.)

1903 Brinton, A. G., Box 5852, Johannesburg, South Africa.

1909 Broachâ, B. B., Karachi Eye Hospital, Karachi, India.

1886 Bronner, Adolph, M.D., 33, Manor Row, Bradford. (C. 1900-3.)

1901 *Brooks, R. Philip, 14, Welbeck Street, W.

1895 Browne, J. Walton, M.D., 10, College Square, North Belfast.

1901 Buchanan, Leslie, 8, Royal Crescent West, Glasgow.

1907 Buckland, Francis, M.D., Moorland Court, Poole Road, Bournemouth.

1907 Burdon-Cooper, J., M.D., 12, The Circus, Bath.

O.M. †Burnham, G. H., M.B., 157, Simcoe Street, Toronto, Canada.

1909 Butler, Thomas H., M.D., B.Ch., 26, Adelaide Road, Leamington.

1902 Buzzard, E. Farquhar, M.D., 78, Wimpole Street, W. (C. 1908-9. S. 1909-12.)

1897 †Byers, W. Gordon M., M.D., 346, Mountain Street, Montreal.

1892 †Caiger, Herbert, M.B., Burghersdorp, Cape Colony.

ELECTED

1905 Campbell, C. A., 93, Bloor Street E., Toronto.

1891 Campbell, E. Kenneth, M.B., 23, Wimpole Street, W.

1891 Cargill, L. Vernon, 35, Cavendish Square, W. (C. 1905-8.)

1895 Cartwright, E. H., M.D., c/o Union and Smiths Bank, 66, Charing Cross, S.W.

1911 Chambers, W. J., 212, VII Avenue W., Calgary, Alberta, Canada.

1885 Clarke, Ernest, M.D., B.S., 3, Chandos Street, Cavendish Square, W. (C. 1893-6. V.-P. 1910-12.)

1911 Clegg, John Gray, M.D. (C.), 22, St. John Street, Manchester.

1905 Clements, E. C., 3, Lindum Road, Lincoln.

1907 Cobbledick, Arthur Stanley, M.D., B.S., 21, Bolton Street, Mayfair, W.

1885 Collins, E. Treacher (V.-P.), 17, Queen Anne Street, W. (*Pres.* 1917-18. V.-P. 1905-8; 1916-17. C. 1889-92; 1901-4. S. 1898-1901.)

1886 Collins, Sir W. J., K.C.V.O., M.S., M.D., 1, Albert Terrace, Gloucester Gate, Regent's Park, N.W.

1901 Cooke, Arthur, M.B., 69, Bridge Street, Cambridge.

1901 Cooper, Ludford, M.D., 19, Victoria Street, Rochester, Kent.

1909 Coorey, Edward A., M.D., Bolton, Bainbalapitiya, Ceylon.

1894 †Coote, Patrick, M.D., 73, St. Ann Street, Quebec, Canada.

1914 Coppez, Henri, M.D., 24 Avenue des Arts, Brussels.

1904 Corbett, W. J., 18, Weymouth Street, W.

1898 Coulter, Robert J., M.B., 15, Stow Park Crescent, Newport, Mon.

1895 †Courtenay, J. D., M.D., Ottawa, Canada.

1909 Craig, James A., M.B. (C.), 11, University Square, Belfast.

ELECTED

1901 Crawley, F. C., M.D., 5, Fitzwilliam Place, Dublin.

1907 Cree, Robert Ewart, M.D., 40, Jesmond Road, Newcastle-on-Tyne.

1899 Cresswell, F. P. S., M.B., B.S., 24, Windsor Place, Cardiff.

1904 Cridland, A. Bernard (C.), Salisbury House, Chapel Ash, Wolverhampton.

O.M. Critchett, Sir G. Anderson, Bart., C.V.O., 21, Harley Street, W. (*Pres.* 1899-1901. C. 1883-6. V.-P. 1894-7, 1902-5.)

1898 Critchley, Harry G., M.D., 83, Park Lane, Croydon.

1906 Crocket, A. Pierce. (Address uncommunicated.)

1881 Cross, F. R., M.B., LL.D., Worcester House, Clifton, Bristol. (*Pres.* 1913–15. V.-P. 1898-1901. C. 1891-4.)

1902 Cruise, R. R., C.V.O. (C.), 85, Harley Street, W.

1912 Cummins, J. D., M.B., 10, Clare Street, Dublin.

1904 Cunningham, H. H. B., M.D., Lt.-Col. R.A.M.C., 30, University Square, Belfast. *Trans.* to Messrs. Kelly and Co., 41, Donegal Street, Belfast.

1905 Cunningham, Major J. F. (C.), R.A.M.C., B.E.F., France.

1916 Danis, Marcel, M.D., Rue de la loi 134, Brussels, Belgium.

1907 Davidson, Alex. Dyce, M.B., "Hollydene," Cholmeley Park, Highgate, N.

1917 Davidson, Isaac A., M.D., 3, Laurington, Antrim Road, Belfast.

1884 Davidson, Sir James McKenzie, M.B., 26, Park Crescent, W. (C. 1892-5.)

1903 Davies, David, M.B., 8, Lonsdale Gardens, Tunbridge Wells.

1908 Davies, D. L., M.S., M.D., 31, Newport Road, Cardiff.

1889 †Davis, G. C., 173, Liverpool Street, Sydney, New South Wales.

1897 Dawnay, Arch. Hugh Payan, 126, Harley Street, W.

ELECTED

1909 Dé, Chandra Mohan (Rai Bahadur), Med. School, Agra, U.P., India.

1914 De Lapersonne, Prof., M.D., 30 Rue de Lisbonne, Paris.

1903 Dean, C. W., Lindow Square, Lancaster.

1918 Delany, Thomas H., M.D., F.R.C.S., 29, Upper Fitzwilliam Street, Dublin.

1903 Dickson, R. H., Nelson Place, Newcastle-under-Lyme, Staffordshire.

1910 Dighton, Chas. A. Adair, M.B., 73, Rodney Street, Liverpool.

1881 Dixon, W. E., Oulton Lodge, Oulton Broad, Lowestoft.

1889 Dodd, Henry Work, 136, Harley Street, W. (C. 1902-5).

1907 Dombrain, Ernest A., 205, Macquarie Street, Sydney, N.S.W.

1905 Dorrell, E. A., 45, Welbeck Street, W.

1881 *Drake-Brockman, E. F., 18, Hanover Street, W. (C. 1895-8.)

1889 †Drake-Brockman, Herbert E., Col. I.M.S., c/o Thomas Cook and Son, Ludgate Circus, E.C.

1895 Du Boulay, H. H., 2, Royal Terrace, Weymouth.

1909 Duggan, J. N., Sir J. C. Ophthalmic Hospital, Girguina, Bombay.

1886 Dunn, Percy, 54, Wimpole Street, W.

1900 Eason, Col. H. L., M.B. (C.), R.A.M.C., 62, Portland Place, W.

O.M.*Edmunds, Walter, M.B., 2, Devonshire Place, Portland Place, W. (C. 1885-8.)

1902 †Elliot, Robert Henry, Lt.-Col. I.M.S. (retired), M.D., Sc.D., 54, Welbeck Street, W.

1903 Ellis, W. F., c/o Messrs. Holt, 3, Whitehall Place, S.W.

1908 Emmerson, Herbert H., 275, Glossop Road, Sheffield.

1883 *Emrys-Jones, A., M.D., 10, St. John Street, Manchester.

1918 Evans, Frederick Hudson, The Glen, 161, Lewisham Road, S.E.

ELECTED

1900 Evans, J. Jameson, M.D., 41, Newhall Street, Birmingham.

1902 Evershed, A. R. F., 22, Harley Street, W.

1907 Fenton, Lt.-Col. A., M.B., I.M.S., c/o Messrs. Thos. Cook and Son, Rangoon.

1911 Fenwick, George, New Zealand Hospital, Walton-on-Thames.

1888 Fergus, A. Freeland, M.B., 22, Blythswood Square, Glasgow. (C. 1905-8.)

O.M. †Ferguson, H. L., M.D., Dunedin, New Zealand.

1894 †Fischer, E. C., M.D., Cairo, Egypt.

1904 Fisher, Lt.-Col. J., D.S.O., I.M.S., c/o Messrs. Grindlay and Co., 54, Parliament Street, S.W.

1895 Fisher, J. Herbert, M.B. (C.), 83, Wimpole Street, W. (C. 1904-7; 1911-12; 1918. S. 1907-10.)

1912 Flaxman, Samuel C. R., Peckham House, Peckham, S.E. 15.

1917 Fleming, Norman B. R., M.B., Royal Westminster Ophthalmic Hospital.

1889 Flemming, Percy, M.D., 70, Harley Street, W. (V.-P. 1911–13; C. 1901-4.)

1892 Folker, Herbert Henry, Hanley, Staffordshire.

1886 Ford, A. Vernon, 8, Outram Road, Southsea.

O.M. Frost, W. Adams, Shepherd's Well, Forest Row, Sussex. (L. 1900-6. V.-P. 1906-9.)

1895 Galloway, A. Rudolf, M.B., 250, Union Street, Aberdeen.

1887 †Gardner, John J., M.D., 128, Bishop Street, Montreal, Canada.

1913 Ghaswala, K. S., 3, Churchgate Street, Fort Bombay, India; and c/o Sir Cowasji Jehangir Ophthalmic Hospital, Byculla, Bombay.

1912 Gibb, H. P., M.B., 91, Harley Street, W.

1889 Gibbs, Alfred N. G., 52, Whiteladies Road, Clifton.

1902 †Gibson, J. Lockhart, M.D., Wickham Terrace, Brisbane, Australia.

1917 Giri, D. V., 7, Victoria Place, Eastbourne.

ELECTED

O.M. Glascott, C. E., M.D., Rosemullion, Budleigh Salterton, Devon. (C. 1896-9. V.-P. 1902-5.)

1885 †Godfray, Alfred Charles, St. Heliers House, St. Heliers, Jersey.

1899 Goldsmith, G. Harvey, M.B., Bedford.

1907 Goulden, Charles Bernard, M.D., 5, Union Street, Oldham.

1904 Gowans, Thos., M.B., 4, Abbotsford Terrace, Newcastle-on-Tyne.

1897 Granger, F. M., 18, Nicholas Street, Chester.

1895 †Grant, H. Y., M.D., 414, Delaware Avenue, Buffalo, U.S.A.

1895 †Gray, James, M.D., 119, Robert Street, Toronto, Canada.

1887 Green, Edwin Collier, 27, Friar Gate, Derby. (C. 1903-4.)

1903 Greene, Arthur, M.D., 4, Theatre Street, Norwich.

1911 Greeves, Reginald A., M.B., 14, Harley Street, W.

1895 Griffin, W. Watson, M.B., 68, Brunswick Place, Hove, Brighton.

1885 *Griffith, A. Hill, M.D., 17, St. John Street, Manchester. (V.-P. 1905-8. C. 1893-6.)

1910 Griffith, Arthur Donald, M.B., 3, Upper Wimpole Street, W.

1894 Grimsdale, Harold, M.B., 3, Harley Place, Marylebone Road, N.W. (C. 1907-10.)

1899 Gruber, Rudolph, M.D., 81, Harley Street, W.

1908 Gunning, C. J. H., 6, Hertford Street, Mayfair, W.

1898 Guthrie, Leonard G., M.D., 15, Upper Berkeley Street, W.

1910 Haab, Prof. O., 41, Pelikanstrasse, Zurich, Switzerland.

1889 Hailes, C. D. G., M.D., Hawkesdale, 27, Alma Road, Clifton, Bristol.

1885 †Haines, Humphrey, Auckland, New Zealand.

1902 †Halliday, J. C., M.B., Macquarie Street, Sydney, N.S.W.

ELECTED

1900 Hallidie, Andrew, M.B., 7, Devonshire Place, Eastbourne.

1896 Hamilton, Robert J., 82, Rodney Street, Liverpool.

1878 †Hamilton, T. K., M.D., Wakefield Street, Adelaide, South Australia.

1912 Hanafin, Major P. J., D.S.O., R.A.M.C. (Address uncommunicated.)

1901 Hancock, Edw. D., Merrow Grange, Guildford.

1908 Hanna, Henry, M.B., 57, University Road, Belfast.

1901 Hanson, Reginald E., M.B., 20, Kensington Park Gardens, W.

1900 Harman, N. B., M.B., 108, Harley Street, W.

1902 Harries-Jones, E., M.D., 16, Castilian Street, Northampton.

1910 Harston, George M., M.D., Hong Kong.

1882 *Hartridge, Gustavus, 12, Wimpole Street, W. (C. 1889-92, 1895-8. S. 1892-5. V.-P. 1910-11.)

1905 †Harty, G. W., M.B., Ch.B., Wellington, New Zealand.

1899 Hawkes, C. S., Bethnal Green Military Hospital, London, E.

1901 Hawthorne, C. O., M.D., 63, Harley Street, W.

1908 Hay, Percival J., M.D., 350, Glossop Road, Sheffield.

1892 Haydon, Frank, Apothecaries' Hall, Water Lane, Blackfriars, E.C.

1899 Henderson, Edward E., M.B., 6, Lower Berkeley Street, Portman Square, W.

1903 Henderson, Thomson, M.D., 15, The Ropewalk, Nottingham.

1896 Henry, R. Wallace, M.D., 6, Market Street, Leicester.

1905 Hepburn, Malcolm Langton, M.D., 111, Harley Street, W.

1897 Herbert, Lt.-Col. Herbert, I.M.S. (retired), 9, Regent Street, Nottingham. (C. 1911–13.)

1887 *Hern, John, M.D., Semmercote, Darlington.

1910 Heron, Davis, Major I.M.S. Mess, Grosvenor Road, S.W.

ELECTED

1905 Hewkley, F., The Limes, St. James, Hatcham, S.E.

1900 Heyliger, E. D. Scott, M.B., C.M., 89, Preston New Road, Blackburn.

1895 Hickman, H. R. Belcher, M.B., The Hollies, Wanstead, N.E.

O.M. Higgens, Charles, 52, Brook Street, W. (C. 1880-3, V.-P. 1901-4.)

1913 Hill, Rowland, M.D., 7, University Road, Belfast.

1916 Hine, Montague, M.D., 30, Weymouth Street, W.

1888 *Hinnell, J. S., M.D., 62, Garland Street, Bury St. Edmunds.

1905 Hird, R. B., M.D., 52, Newhall Street, Birmingham.

1899 Hobday, James, M.B., Beverley House, Colney Hatch Lane, N.

1897 Hogg, G. H., M.D., 37, Brisbane Street, Launceston, Tasmania.

1911 Holmes, Lt.-Col. Gordon M., C.M.G., M.D., (C.), R.A.M.C., B.E.F., France. (S. 1912–15.)

1889 Holthouse, Edwin H., M.B., 35, Nottingham Place, W.

1917 Holyoak, W. L., M.D., 45, Welbeck Street, W.

1905 Hosford, J. S., 7, Chandos Street, W.

1893 †Howe, Lucien, 520, Delaware Avenue, Buffalo, N.Y., U.S.A.

1908 Hudson, A. C., M.D., 50, Queen Anne Street, W.

1889 †Hughes, Samuel H., 173, Macquarie Street, Sydney, New South Wales.

1893 †Hughes, Wilfrid Kent, M.B., 102, Collins Street, Melbourne.

1908 Hunter, George, 31, Bridge Street, Inverness.

1901 Inman, Wm., M.B., 55, Elm Grove, Southsea.

1883 †Jackson, James, M.D., Collins Street East, Melbourne, Australia.

1898 James, George Brooksbank, 5, Harley Street, W. (C. 1911–13.)

1908 James, Robert Rutson (S.), 6, Lower Berkeley Street, W.

ELECTED

1905 Jaques, R., 20, Athenæum Street, Plymouth.

1918 Jellett, James William Henry, M.D., Dublin, 11, Beresford Street, Waterford.

1883 †Jenkins, E. J., M.D., Nepean Towers, Douglass Park, Sydney, N.S.W., Australia.

1908 Jeremy, H. Rowe, 8, Chingford Road, Walthamstow, Essex.

1910 Jewell, William H., M.D., 27, Queen Anne Street, W.

1882 Johnson, G. Lindsay, M.D., 5 and 6, Castle Mansions, Eloff Street, Johannesburg, S.A.

1888 †Johnston, Geo. D., Georgia Street, Vancouver, British Columbia.

1898 *Jones, George, M.B., 8, Church Terrace, Lee, S.E.

1897 Jones, Hugh E., 19, Rodney Street, Liverpool.

1894 †Jones, R. H., M.B., B.S., 209, Macquarie Street, Sydney, New South Wales.

1914 Joseph, Hugh Percival, The Hospital Bungalow, Gallé, Ceylon.

1917 Joynt, Ivor William, Royal London Ophthalmic Hospital, E.C.

1905 Juler, F. A., M.B., 24, Cavendish Square, W.

O.M. Juler, H. E., 24, Cavendish Square, W. (C. 1886-9. V.-P. 1900-2.)

1914 Karani, N. N., "Eye Clinic," near Edward Theatre 18, Kalbadevi Road, Bombay.

1899 Keeling, G. S., M.D., Attleborough, Norfolk.

1900 †Kelsall, H. T., M.D., 1, Devonshire Terrace, Perth, W. Australia.

1898 †Kendall, H. W. Martindale, Wellington, New Zealand.

1888 †Kenny, Augustus Leo, M.B., 87, Collins Street, Melbourne, Victoria, Australia.

1913 Killen, W. M., M.D., 34, Clifton Street, Belfast.

1904 Killick, Chas., M.D., Trinity House, Maidstone.

1906 Kilkelly, Col. P. P., I.M.S. (retired), c/o Messrs. H. S. King and Co., Pall Mall, S.W.

ELECTED

1895 Knaggs, Robert Lawford, M.D., 27, Park Square, Leeds.

1881 †Knaggs, S. T., M.D., Wellington, Bondi Road, Bondi, Sydney, N.S.W.

1910 Knapp, Arnold, M.D., 10, East 54th Street, New York, U.S.A.

1911 Lang, B. T., B.C., 22, Cavendish Square, W.

O.M. Lang, William, 22, Cavendish Square, W. (C. 1886-9. V.-P. 1900-3. (*Acting Pres.* 1903.)

O.M. Lawford, J. B., M.D., 99, Harley Street, Cavendish Square, W. (C. 1886-9; 1898-1901. S. 1895-8. V.-P. 1905; 1913-16. T. 1905-11. *Pres.* 1911-13.)

1889. *Laws, Wm. G., M.B., 3, East Circus Street, Nottingham. (C. 1909-11.)

1896. Lawson, Arnold, M.D. (T.), 12, Harley Street, W. (V.-P. 1917. C. 1909-1911.)

1895 †Lea, J. Augustus, M.B., Grahamstown, Cape Province, S. Africa.

1885† Le Cronier, Hardwick, St. Heliers, Jersey.

1917 Leask, H. L. G., M.D., 70, Dixon Avenue, Crosshill, Glasgow.

O.M. Lediard, H. A., M.D., 26, Lowther Street, Carlisle. (C. 1900-1.)

1912 Lee, H., M.B., 6, Park Square, Leeds.

1904. †Lee, W. A., Col. I.M.S. (retired), 44, Primrose Hill Road, N.W.

1911 Letchworth, T. W., M.B., 68, Claremont Road, Surbiton.

1903 Levy, A., M.D., 67, Wimpole Street, W.

1907 Lindsay, W. J., M D., 84, Herne Hill, S.E.

1896 Lister, Col. W. T., C.M.G., M.B., A.M.S. (C.), 5, King Arthur's Terrace, Tintagel, Cornwall. (C. 1907-10).

1902 Little, Andrew, M.B., 114, Manningham Lane, Bradford, Yorks.

1892 Lodge, Samuel, jun., M.D., 28, Manor Road, Bradford.

ELECTED

1911 Loosely, Alfred E. A., M.B., 25, New Cavendish Street, W.

1903 †Lückhoff, James, M.D., Rhodes Buildings, St. George's Street, Capetown.

1883 Lunn, J. R., The Haven, Mill Road, Worthing. (C. 1892-5.)

1899 Lyle, H. Willoughby, M.D., Speldhurst, Elmfield Road, Bromley, Kent.

1900 MacCallan, Arthur Ferguson, M.B., Public Health Department, Cairo, Egypt.

1913 McCready, W., M.B., 2, University Square, Belfast.

1918 McCulloch, R. J. P., M.B., L.R.C.P., 47, Campbell Street, Belleville, Canada; and Queen Alexandra Military Hospital, Millbank, S.W.

1905 Macdonald, J. G., Imperial Chambers, Dee Street, Invercargill, New Zealand.

1890 *MacGillivray, Angus, M.D., 23, South Tay Street, Dundee. (C. 1902-5.)

1918 Macheil, Capt. Frank A., C.A.M.C., West Cliff Canadian Eye and Ear Hospital, Folkestone.

1902 Mackay, D. Matheson, M.D., 15, Albion Street, Hull.

1888 *Mackay, George, M.D., 20, Drumsheugh Gardens, Edinburgh. (C. 1900-2. V.-P. 1906-9.)

1889 †Mackenzie, F. Wallace, M.B., 139, Upper Willis Street, Wellington, New Zealand

1895 McKenzie, H. V., M.D., Elmbank, Abbey Road, Torquay.

1889 MacLehose, Norman M., M.B., 18, Harley Street, W. (C. 1902-5.)

1897 †Maclennan, Duncan N., M.D., 126, Bloor Street West, Toronto.

1892 †MacLeod, Charles G., M.D., 157, Macquarie Street, Sydney, N.S.W.

1902 McMullen, W. H., M.B., O.B.E., 4, Chandos Street, Cavendish Square, W. (C. 1914-17.)

1911 McNabb, Henry H., M.D., 8A, St. John Street, Manchester.

ELECTED

1912 McPherson, Major, I.M.S., c/o Ophthalmic Hospital, Bombay, India.

1911 MacQueen, J. F. (Address uncommunicated.)

1899 Maddox, Ernest E., M.D., Glenartney, Poole Hill, Bournemouth. (C. 1904-6.)

1918 Maghy, Charles Alfred, Royal London Ophthalmi Hospital, E.C.

1883 †Maher, W. Odillo, M.D., Craigmish, 185, Macquarie Street, Sydney, N.S.W.

1899 †Manché, Charles, B.A., M.D., 33, S^da. Alessandro, Valletta, Malta.

1901 †Manning, Leslie S., M.B., Christchurch, New Zealand.

1911 Manson, W. H., M.D., 5, Clifton Place, Glasgow, W.

1904 Markus, Charles, M.D., 28, Wimpole Street, W.

1883 †Marlow, Frank William, M.D., 200, Highland Street, Syracuse, N.Y., U.S.A.

1916 Marquez, M., Dr., Puerta del Sol, 13, Madrid, Spain.

1892 Marshall, Charles Devereux, 112, Harley Street, W. (C. 1903-4. S. 1904-7. C. 1907-10.)

1907 Marshall, James Cole, M.D., 36, Albion Street, Hyde Park, W.

1888 †Martin, Albert, M.D., Wellington, New Zealand.

1905 Massey, A. Yale, M.D., 24, Tavistock Square, W.C.

1918 Mathieu, Capt. Albert, C.A.M.C., West Cliff Canadian Eye and Ear Hospital, Folkestone.

1918 Matthews, Richard H., M.D., 4, Upper Fitzwilliam Street, Dublin.

1916 Maxted, George, M.D., 14, Thorpe Mansions, Norwich.

1914 Maxwell, Miss E. M., M.B., 19, Lower Baggot Street, Dublin.

1904 May, H. J., M.B., B.C., 21, The Avenue, Southampton

1893 Maynard, Frederic Pinsent, Lt.-Col., I.M.S., 6, Little Russell Street, Calcutta, India.

1902 Mayou, Stephen (S.), 30, Cavendish Square, W. (C. 1912–15.)

ELECTED

1912 Mead, John Clarke, M.B., 55, High Street, Lowestoft.

1901 Menzies, J. A., M.B., 9, Castle Hill Avenue, Folkestone.

1897 Miller, G. Victor, M.D., 2, Barrington Crescent, Yarm Lane, Stockton-on-Tees.

1897 †Minnes, Robert Stanley, M.D., 127, Metcalfe Street, Ottawa, Ontario.

1911 Mitchell, Leonard J. C., 4, Collins Street, Melbourne.

1896 Mooney, Herbert C., M.B., 33, Fitzwilliam Place, Dublin.

1908 Moore, Robert F., M.B., 91, Harley Street, W.

1909 Morrell, Reginald A., 13, Harley Street, W.

O.M. Morton, A. Stanford, M.B., 133, Harley Street, W. (C. 1886-9. V.-P. 1902-5.)

1896 Mott, F. W., M.D., F.R.S., 25, Nottingham Place, W. (V.-P. 1904–7.)

1908 Moxon, Frank, M.B., B.S., 56, Seymour Street, Portman Square, W.

1916 Mulholland, P. J. H., 5, University Terrace, Belfast.

1909 Naylor, W. Roebuck, 14, Carr Road, Nelson, Lancs.

1909 Nell, Andreas, Victoria Eye and Ear Hospital, Colombo, Ceylon.

1881 Nicholson, A., M.B., 30, Brunswick Square, Brighton.

1910 Nordenson, Dr. Erik, 10, Wasagatan, Stockholm, Sweden.

1912 Norman, Alfred Clarence, M.D., Durham County and Sunderland Eye Infirmary, Sunderland.

1889 †O'Kinealy, Frederick, Lt.-Col., I.M.S., c/o Messrs. King, Hamilton and Co., 7, Hare Street, Calcutta.

1899 Oldmeadow, Lloyd J. H., M.D., Kineton, Warwickshire.

1911 Oliver, Capt. M. W. B., M.B., R.A.M.C., 24th General Hospital, B.E.F., France.

1914 Oliver, George H., 284, Manningham Lane, Bradford.

1899 Ormond, Arthur Wm. 7, Devonshire Place, W. (C. 1910-12).

ELECTED

1892 †Orr, Andrew William, M.D., 71, Wickham Terrace, Brisbane.

1890 †Osborne, A. B., M.D., 46, McNab Street South, Hamilton, Canada.

O.M. Owen, D. C. Lloyd, M.D., 41, Newhall Street, Birmingham. (V.-P. 1891-4.)

1905 Owen, S. A., M.D., 15, Queen Anne Street, W.

1890 †Palmer, L. Loran, M.D. (Address uncommunicated.)

1894 *Parker, Herbert, Saragossa House, New Street, Henley-on-Thames.

1899 Parker, Herbert George, 13, Chorley New Road, Bolton.

1900 Parsons, John Herbert, M.B., D.Sc., 54, Queen Anne Street, W. (C. 1909-12).

1887 †Patel, D. H., Bai Hirabai, B. J. Charitable Dispensary Tardeo, Bombay.

1907 Paterson, James V., M.B., 11, Melville Street, Edinburgh.

1900 †Patkar, Bhagvant Sakharam, Carnac Road, Kalkadeir Post, Bombay, India.

1902 Paton, Leslie, M.B., 29, Harley Street, W. (C. 1912–15.)

1918 Pearse, Patrick, L.R.C.P., L.R.C.S., 17, The Crescent, Limerick.

1888 Percival, Archibald Stanley, M.B., B.Ch., 25, Ellison Place, Newcastle-on-Tyne. (C. 1906-9.)

1891 Perry, Sir A., M.D., Surgeon-Major, Principal Civil Medical Officer, Colombo, Ceylon.

1889 †Perry, Francis F. (Address uncommunicated.)

1895 Pickard, Ransom, M.D., 31, East Southernhay, Exeter.

1916 Pike, N., M.D., 10, York Terrace, St. George's Road, Cheltenham.

1910 Pisani, Lt.-Col. L. J., I.M.S. (retired), 49, Wimpole Street, W.

ELECTED

1900 †Pockley, Francis Antill, M.D., 227, Macquarie Street, Sydney, N.S.W.

1903 Pollock, W. B. Inglis, M.D., 21, Woodside Place Charing Cross, Glasgow.

1896 *Pooley, G. H., 70, Hanover Street, Glossop Road, Sheffield.

1894 †Pope, R. J., M.D., Box 497, G.P.O., Sydney, N.S.W.

1902 Potter, Bernard E., M.B., 26, Park Crescent, Regent's Park, W. 1.

1903 *Potts, George, Bower Cottage, Tonbridge Road, Maidstone.

1899 Price, Henry J., Maldon, Essex.

1882 Prichard, Arthur William, 6, Rodney Place, Clifton, Bristol.

1908 Pridmore, Walter G., Major I.M.S., c/o Grindlay and Co., 54, Parliament Street, S.W.

1903 Pritchard, Eric L., M.D., 70, Fairhazel Gardens, N.W.

1892 Pronger, Charles Ernest, Litchdon, Harrogate.

1909 Prowse, S. Willis, M.D., 706, Union Bank Buildings, Winnipeg, Canada.

1911 Quick, Hamilton E., M.B., 51, Bryn Road, Swansea.

1889 Ramsay, A. Maitland M.D. (V.-P.), 15, Woodside Place, Glasgow. (C. 1909-11.)

1899 Read, E. I., Government Medical Officer, Port of Spain, Trinidad, West Indies.

1881 †Reeve, R. A., M.D., 22, Shuter Street, Toronto, Canada. (V.-P. 1907-10.)

1891 Reynolds, Austin Edward, 35, Finsbury Square, E.C.

1913 Riad, M., Kasr el Aino Hospital, Cairo, Egypt.

1897 Richmond, R., M.D., 29, Lingfield Road, Wimbledon, S.W.

1892 Ridley, Nicholas C., M.B., 27, Horse Fair Street, Leicester.

ELECTED

1914 Roberts, Miss Adeline Mary, M.D., 4, Nottingham Place, W.

1885 *Roberts, Edward, Penywern, Aberystwith, Cardiganshire.

1896 †Roberts, Col. Sir James R., C.I.E., M.B., I.M.S., c/o Messrs. King, King and Co., Bombay.

1891 Robertson-Fullarton, Archibald Louis, M.B., C.M. Kilmichael, Brodrick, Isle of Arran.

O.M. Rockliffe, W. C., M.D., 17, Charlotte Street, Hull. (C. 1892-5. V.-P. 1900–3.)

1912 Rodger, Douglas, M.B., Dept. of Public Instruction, Brisbane, Queensland.

1898 Roe, Arthur Legge, 43, Pryme Street, Hull.

1898 Roll, G. W., M.B., B.C., 7, Upper Wimpole Street, W. (C. 1910-12.)

1890 Rolston, John R., 14, The Crescent, Plymouth.

1891 Roper, Arthur Charles, The Shrubbery, Exeter.

1882 †Roth, Reuter E., D.S.O., 42, College Street, Hyde Park, Sydney, New South Wales.

1893 *Rowan, John, M.B., 10, Woodside Crescent, Charing Cross, Glasgow.

1899 *Roxburgh, A. B., M.B., 3, Manchester Square, W.

1881 †Rudall, J. T., 61, Spring Street, Melbourne, Australia.

1895 Russell, J. S. Risien, M.D., 44, Wimpole Street, W. (C. 1900–3. S. 1903-6. C. 1906-9.)

1903 Rutherford, A. Freer, M.B., 19, Abbey Road, Barrow-in-Furness.

1900 †Sager, D. S., M.D., Brantford, Ontario, Canada.

1884 *Sandford, Arthur W., M.D., 13, St. Patrick's Place, Cork. (C. 1896-9. V.-P. 1902-5.)

1918 Santos, Costa, Lisbon, Portugal.

1918 Saunders, P. W., M.B., 63, Wimpole Street, W.

1907 Scott, G. Affleck, M.B., Kingsland House, Ballarat, Victoria.

ELECTED

1892 Shannon, John Rowlands, M.D., 17, East 38th Street, New York City, U.S.A.

O.M. Sharkey, Sir S. J., M.D., 24a, Portland Place, W. (S. 1885-8. C. 1888-91. V.-P. 1900-2.)

1918 Shaw, David le Baron, Royal London Ophthalmic Hospital.

1883 Shears, Charles H. B., 19, Upper Duke Street, Rodney Street, Liverpool. (C. 1900–3.)

1899 Sinclair, A. H. H., M.B. (C.), 3, Charlotte Square, Edinburgh.

1891 Sinclair, Walter William, M.B., 3, Arcade Street, Ipswich. (C. 1909-1912.)

1912 Smith, D. Priestley, M.B., 52, Frederick Road, Edgbaston, Birmingham.

1889 Smith, John, M.D., Brycehall Kirkcaldy.

O.M. Smith, Priestley, M.B., M.Sc., 95, Cornwall Street, Birmingham. (V.-P. 1887-90; 1898-1901; 1907-10. C. 1883-6. *Pres.* 1905-7.)

1907 Smith, W. Harvey, M.D., 173, Portage Ave., E. Winnipeg, Canada.

1903 Smyth, Ernest J., M.B., Sevington, Epsom Road, Guildford.

1911 Snell, H. Cecil, 70, Hanover Street, Glossop Road, Sheffield.

1910 Snellen, Prof. H. Biltstraat, Utrecht, Holland.

1901 Snowball, Thomas, M.B., 83, Bank Parade, Burnley.

1889 Spencer, Matthew H., M.D., 92, Oxford Gardens, North Kensington, W.

1889 Spicer, Wm. T. Holmes, M.B. (L.), 5, Manchester Square, W. (C. 1900-2. L. 1907-12. V.-P. 1910-12.)

1905 Sprawson, F. C., M.B., 7, Imperial Terrace, Claremont Park, Blackpool.

1916 Stack, E. H., M.B., B.C., Arvalee, Clifton Down Road, Bristol.

ELECTED

1895 †Stamberg, A. C., M.B., 5, Windsor Crescent, St. Heliers, Jersey, Channel Islands.

1886 Stephenson, Sydney, M.B. (V.-P.), 33, Welbeck Street, W. (C. 1898-1901, 1904-7. S. 1901-4.)

1896 Stevenson, Edgar, M.D., 39, Rodney Street, Liverpool.

1904 Stevenson, John Simpson, M.B., Royal Exchange Buildings, Cathedral Square, Christchurch, New Zealand.

1905 Steward, E. S., 10, Princes' Square, Harrogate.

1913 Stewart, John Barbour, M.B., 20, Charing Cross Mansions, Glasgow.

1893 Stirling, Alexander Williamson, M.D., Empire Buildings, Atlanta, Georgia.

1887 †Stirling, J. W., M.B., 255, Mountain Street, Montreal, Canada.

O.M. Story, J. B., M.B. (*Pres.*), 6, Merrion Square North, Dublin. (C. 1885-8. V.-P. 1894-7.)

O.M. †Sturge, W. A., M.D., Icklingham Hall, Mildenhall, Suffolk.

1904 Sykes, Walter, 31, Winckley Square, Preston.

1888 *Sym, William George, M.D. (C.), 12, Alva Street, Edinburgh. (C. 1906-9.)

1883 †Symons, Mark Johnston, M.D., North Terrace, Adelaide, South Australia.

1907 Tampi, K. R., Trivandrum, South India.

O.M. Tay, Waren, 61, Oakfield Road, West Croydon. (C. 1880-2.)

1903 Taylor, H. H., 36, Brunswick Square, Hove, Brighton.

1899 Taylor, Inglis, M.B., 31, Cavendish Square, W.

1891 Taylor, James, M.D., 49, Welbeck Street, W. (V.-P. 1910-11. C. 1894-7, 1900–3. S. 1897-1900. T. 1911-1918.)

1889 Taylor, S. J., M.B., 44, Prince of Wales' Road, Norwich. (C. 1904-7.)

1900 Thomas, Frank G., M.B., 22, Walter Road, Swansea.

ELECTED

1903 Thomas, R. Russell, 40, St. Andrew's Crescent, Cardiff.

1895 Thompson, A. Hugh, M.D., 36, Weymouth Street, W. (C. 1910-12.)

1895 Thompson, George W., M.B., 80, Harley Street, W.

1895 *Thompson, Robert, M.D., B.S., Bunya Bunya, Wickham Terrace, Brisbane, Queensland.

1911 Thomson, Eric A., M.B., British Ophthalmic Hospital, Jerusalem.

1905 Thomson, H. Wright, M.D., 3, Sandyford Place, Glasgow.

1898 Thomson, W. Ernest, M.D., Viewbank, Bothwell, Lanarkshire.

1883 †Tobin, William, c/o Messrs. John Tobin and Co., Halifax, Nova Scotia, Canada.

1900 Tomlinson, John H., Tudor Lodge, Egham, Surrey.

1904 †Tooke, Frederick T., M.D., 36, Mountain Street, Montreal, Canada.

1895 Toombs, Herbert George, 193, Cromwell Mansions, Cromwell Road, S.W.

1904 Townsend, T. H D., M.B., 14, St. Patrick's Hill, Cork.

1912 Traquair, H. Moss, M.D., 46, Melville Street, Edinburgh.

1905 Trench, F. P., M.B., 81, Eaton Terrace, S.W.

1902 †Trilokekar, V. S., 308, Lohar Street, Bombay, India.

1917 Tuckett, Ivor Lloyd, M.D., Punchardon William, near Letchworth, Herts.

O.M. Tweedy, Sir John, LL.D., 100, Harley Street, W. (*Pres.* 1903-5. C. 1884-7. V.-P. 1891-4, 1905-8.)

1898 Tyrrell, F. Astley-Cooper, M.B., 27, Queen Anne Street, W.

1883 Uhthoff, J. C., M.D., Wavertree House, Furze Hill, Brighton. (C. 1905-8. V.-P. 1908-12.)

ELECTED

1894 Usher, C. H., M.B. 3, Bon Accord Square, Aberdeen. (C. 1909-1912.)

1916 Valentine, John A., M.D., 65, Devonshire Avenue, Southsea.

1913 Viner, Geoffrey, M.D., 15, Devonshire Place, W.

1888 Walker, Cyril H., M.B., 8, Oakfield Road, Clifton, Bristol. (C. 1907-10).

1892 Walker, H. Secker, 45, Park Square, Leeds. (C. 1903-6.)

1916 Wallace, William, M.D., 11, Ladbroke Road, W. 11.

1916 Wallis, G. F. C., M.D., 1, Price's Avenue, Cliftonville, Margate.

1900 Wardale, John D., M.B., Carlton Villa West, Jesmond Road, Newcastle-on-Tyne.

1893 Warren, H. Guy S., 201, Macquarie Street, Sydney, Australia.

1914 Weeks, John Elmer, M.D., D.Sc., 46, East 57th Street, New York City, U.S.A.

1910 †Weihen, A. Wallace, M.D., 183, Macquarie Street, Sydney, N.S.W.

1887 Wells, Arthur P. L., M.B., 48, Belzize Square, Hampstead, N.W. (C. 1896-9.)

1885 Werner, Louis, M.B., 31, Merrion Square North, Dublin. (C. 1902-5.)

1908 Wharton, John, M.D., 21, St. John Street, Manchester.

O.M. *Wherry, G. E., M.B., Corpus Buildings, Cambridge (C. 1897-1900.)

1895 Whitehead, Arthur Longley, M.B., 31, Park Square, Leeds. (C. 1912–15.)

1918 Whittington, Capt. T. H., General Military Hospital, Colchester. Home address: Oakfield, Carshalton Road, Sutton, Surrey.

ELECTED.

O.M. Williams, R., 125, High Street, Bangor, North Wales. (V.-P. 1896-9.)

1888 †Willis, C. Fancourt, C.B., M.D., Col., I.M.S. (retired), Frith Manor, East Grinstead.

1914 Wilson, James Alexander, M.D., The Lord Derby War Hospital, Warrington. Home address: 4, Central Avenue, Cambuslang, Glasgow.

1911 Wilson, S. A. Kinnier, M.D. (C.), 14, Harley Street, W. (S. 1915-17.)

1900 Wood, C. G. Russ, 12, St. John's Hill, Shrewsbury.

1889 Wood, David J., M.B., National Mutual Building, Church Square, Cape Town, South Africa.

1903 Wood, Percival, The Grange, Crawley.

1909 Wood, R. Moorsom, 32, Beaumont Street, W.

O.M.* Woodhead, G. Sims, M.D., LL.D., Dysart House, Luard Road, Cambridge. (C. 1894-5. V.-P. 1905-8.)

1899 *Worth, Claud, 138, Harley Street, W.

1910 Worton, A. S., M.D., 7, Manchester Square, W. 1.

1890 *Wray, Chas., Bank Chambers, North End, Croydon.

1898 †Wright, Edward Wm., M.D., 115, Montague Street, Brooklyn, New York.

1908 Wright, F. R. Elliston, M.B., Braunton, North Devon.

1896 Yarr, Col. Sir Michael T., K.C.M.G., C.B., R.A.M.C., Army and Navy Club, Pall Mall, S.W.

1910 Yearsley, J. Herbert, "Giffnock," 6, Christchurch Road, Bournemouth.

1917 Young, George, M.D., Cambridge Road, Colchester.

1912 Zorab, Arthur, M.B., 21, Carlton Crescent, Southampton.

RULES.

1. Object of the Society.—The object of the Society is the cultivation and promotion of Ophthalmology.

2. Meetings.—The Society shall hold a meeting each year; the sittings shall be held on two or more consecutive days. On each day there shall be usually two sittings. The date and place of meeting shall be chosen by the Council.

3. Constitution.—The Society shall consist of Ordinary and Honorary members. All medical practitioners whose qualifications are satisfactory to the Council of the Society shall be eligible as Ordinary members. Other Ophthalmological Societies in the British Empire, approved by the Council, may become affiliated.

4. Officers of the Society.—The officers of the Society shall consist of a President, four Vice-Presidents, a Treasurer, two Secretaries and six other members, who together with the President of each affiliated Society or representative accredited by him, shall form the Council and manage the Society's affairs.

5. Election of Members.—Every applicant for admission to the Society shall send to one of the Secretaries a form signed by at least three members, who have personal knowledge of the applicant, or by the President and Secretary of an affiliated Society. Such application shall be submitted to the Council, and if approved the applicant shall forthwith be admitted a member.

6. Honorary Members.—The Council shall have the power of electing as Honorary members men of distinguished eminence in Ophthalmology, or in the sciences bearing upon it.

7. Subscriptions. — The Annual Subscription shall be £1 1*s*. 0*d*. payable in the month of October. No member whose subscription is in arrear shall be entitled to attend the meeting. Any member whose subscription is twelve months in arrear shall cease to be a member of the Society.

8. Election of Officers.—The Officers of the Society shall be elected yearly by Ballot at a Business sitting held during the meeting. A balloting list of the names recommended by the Council for election shall be posted to each member two weeks previously. At the Business sitting twelve shall form a quorum.

9. Duration of Office.—The President shall not hold office for a period of more than two consecutive years. No other member of Council, except the Treasurer, shall hold the same office for more than three consecutive years.

10. President and Vice-Presidents.—The President shall regulate all the proceedings of the Society and Council, state and put questions, interpret the application of the laws, and decide any doubtful points. He shall check irregularities and enforce the observance of the laws. He shall sign the minutes of General and Council meetings. In the absence of the President one of the Vice-Presidents, the Treasurer, or some other member chosen by the meeting, shall perform his duties.

11. Secretaries.—The Secretaries shall manage all correspondence, and shall keep the Minutes of the Society and Council. They shall notify to new members their election. They shall arrange with the President the order of proceedings at the meetings. They shall have charge of and shall keep a register of all papers communicated, and shall be the Editors of the 'Transactions.'

12. Treasurer.—The Treasurer shall receive all moneys due to the Society, and make all payments ordered by the Council, keeping an account of all such receipts and payments. The accounts shall be audited once a year and presented to the Society at the Annual Business Meeting. Two members of the Society shall be nominated by the President to audit the Treasurer's accounts.

13. Meetings of Council.—The Council shall meet as frequently as necessary during the Annual Meeting and at other times if specially convened. Five shall form a quorum. The President shall have a casting vote in addition to his ordinary vote. The Council shall decide upon all questions relating to the reception of communications, and shall have power to submit any paper to referees.

14. Vacancies of Offices.—The Council shall have the power of filling up any vacancies which may occur in any of the offices of the Society between one Annual Meeting and the next.

15. 'Transactions.'—The Society shall publish a yearly volume of 'Transactions' as soon as possible after the Annual Meeting (*vide* Bye Law 1 concerning communications). There shall be an Editorial Committee consisting of the President, the Secretaries and two other members of Council, together with the Secretaries of affiliated Societies. A copy of the 'Transactions' shall be sent to every member whose subscription has been duly paid; and to each Honorary member.

16. Publication of Papers and Discussion.—No paper shall be accepted if it has been published elsewhere. No paper shall be read before the Society unless a copy of it has been sent to the Secretaries at least four weeks before the meeting, together with an abstract suitable for immediate publication in the journals. When possible, notice should be given relating to card cases, and a short abstract of all papers to be read before the Society shall be distributed to all members before the meeting. No report of the meetings of the Society may be published by members or others without the sanction of the Council.

17. Notice of Meeting.—Three months before the date of the Annual Meeting a preliminary notice of the meeting shall be sent to every member.

18. Visitors.—Any member of the medical profession may attend a meeting of the Society (except the Annual Business Meeting) on being introduced by a member of the Society.

The Library has now been transferred to the premises of the Royal Society of Medicine, 1, Wimpole Street.

LIBRARY RULES.

1. The Library shall be open at the same hours as that of the Royal Society of Medicine, viz. from 11 a.m. to 6.30 p.m. daily, except Sundays.

2. Members will be entitled to read the books at 1, Wimpole Street, between these hours, or to take them out on signing a receipt provided for that purpose.

3. A large number of periodicals will be accessible to members in the Library. The current number may not be taken out of the Library.

4. A book must be returned at the expiration of a fortnight if wanted by any other member. The Librarian will in such a case write to the member in whose name the book was taken out.

5. If the book be not returned within four days of such notice a fine of 6d. will be charged for each day that the book is retained beyond such days of grace.

6. Instruments and drawings cannot be taken out of the Library except by special permission.

7. A member taking out a book will be held responsible for its being returned in good condition.

8. Members of the Ophthalmological Society who are also Members of the Section of Ophthalmology of the Royal Society of Medicine can have the full use of the Fellows' Library on payment of an additional guinea instead of the usual subscription of two guineas.

ADAMS FROST COLLECTION OF LANTERN SLIDES.

1. The slides shall be in the custody of the Librarian.

2. They may be lent, for the purpose of teaching, to teachers in any recognised Medical School on application to the Librarian.

3. The regulations under which the slides may be borrowed, together with a list of the slides, shall be printed (*a*) in the *Transactions*; (*b*) in the Catalogue of the Library; (*c*) on leaflets which may be sent to enquirers.

4. Other slides may be added to the collection, but the numbering (in so far as it coincides with that of the figures in Frost's *Fundus Oculi*) shall be retained.

5. The following are the regulations under which the slides may be borrowed:

Regulations for the Loan of Lantern Slides.

1. Not more than 20 slides may be borrowed at one time.

2. Not less than three days' notice of the wish to borrow slides shall be given, and a list giving the numbers of the slides required shall be sent to the Librarian.

3. The borrower shall sign a receipt for the slides, which will be given back to him on their return.

4. The slides must be returned within three days, no other slides can be lent to the same borrower till this has been done.

5. Any slides broken, lost, or damaged shall be replaced or repaired at the expense of the borrower.

THE BOWMAN LECTURE.

Resolution of Council, September 18th, 1883.

"That in recognition of Mr. Bowman's distinguished scientific position in ophthalmology and other branches of Medicine, and in commemoration of his valuable services to the Ophthalmological Society, of which he was the first President, the Council shall each year, or periodically, nominate some person to deliver a lecture before the Society, to be called 'The Bowman Lecture,' which shall consist of a critical *résumé* of recent advances in ophthalmology or in such subject or subjects as the Council shall select, or of any original investigation, and shall be delivered at a special meeting of the Society held for the purpose, at which no other business shall be transacted."

EDWARD NETTLESHIP PRIZE.

On the occasion of Mr. Nettleship's retirement from practice in 1901 a fund was inaugurated by his friends and pupils, with the object of founding an Edward Nettleship Prize for the Encouragement of Scientific Ophthalmic Work, and at a meeting of the General Committee of the above fund on July 2nd, 1902, the following resolutions were adopted :

1. That the prize should be a Gold Medal for the encouragement of scientific ophthalmic work.

2. That the Council of the Ophthalmological Society of the United Kingdom be asked to undertake the custody of the Prize and Fund, and to appoint Trustees.

3. The award of the Medal shall be entrusted to three members of the Ophthalmological Society appointed by the Council, such members to be changed after each award.

4. That the Medal shall be awarded at such intervals as shall be determined upon.

5. That only British subjects be eligible to receive this Prize.

6. That, subject to the discretion of the said Council, the Prize shall be awarded—

(*a*) For the most valuable contribution to Ophthalmology during the three years immediately preceding or since the last award, or

(*b*) For the best work done on any subject previously selected and announced by the Council of the Ophthalmological Society.

7. That in the event of no work being found of sufficient merit an award shall not be made.

Resolution of Council, January 25th, 1906.

"It shall be lawful for the Trustees, with the consent of the Council of the Society, to expend any surplus arising from the non-award of the Medal in any one year, or accumulated during several years, in the purchase of works for the Library of the said Society, such works to be inscribed 'Purchased by the Nettleship Prize Fund'; or, with the consent of the said Council, to expend such surplus in any manner calculated to promote the objects of the Society as defined in the Rules."

N.B.—Additional trustees, in accordance with the terms of the Trust Deed, have to be appointed by some person nominated by the Council.

BYE-LAWS CONCERNING COMMUNICATIONS.

1. The 'Transactions' shall consist of such communications made to the Society, or to affiliated Societies, by or through

members, as may be deemed by the Council suitable for publication. Also of discussions of importance or interest arising out of such communications.

2. No communication to the Society shall occupy more than twenty minutes, and in the subsequent discussion of it no member shall speak more than once, or for more than ten minutes, without the special permission of the Chairman.

3. All communications accepted by the Society become the property of the Society.

4. Communications are admissible which may have been read elsewhere, provided they have not been published.

5. The cost of illustrations shall be borne by the Society so far as, in the opinion of the Council, is consistent with the state of its funds.

6. Reprints of papers may be obtained by authors at their own expense, by arrangement with the printer.

REGULATIONS CONCERNING THE EXHIBITION OF PATIENTS AND OF PATHOLOGICAL SPECIMENS BY CARD.

A. A card, provided by the Society, must be placed conveniently near the patient (unless it is undesirable that it should be read by the patient or friends), and on it must be clearly written an account of the case, *comprising all the particulars intended for publication.* The title only of the case will be announced by the President to the meeting, but the Exhibitor (or his representative) must be present at the meeting, and be willing to read the case and furnish additional details if called upon to do so; the length of such oral communications not to exceed five minutes.

B. Pathological Specimens may, at the discretion of the Exhibitor, be shown by card, and will then be subject to the above regulations. It is particularly to be noted that the description on the card must *comprise all the particulars intended for publication.*

LIST OF COMMUNICATIONS

BROUGHT BEFORE THE SOCIETY DURING THE SESSION 1917–18.

PAGE

I. PRESIDENTIAL ADDRESS.

By E. Treacher Collins 1

II. DISCUSSION ON CONTAGIOUS DISEASES OF THE CONJUNCTIVA.

Papers by—

J. B. Story 9
S. Stephenson 11
J. F. Cunningham and J. Wharton . . 18
H. L. Eason 30
E. Treacher Collins 46

III. DISCUSSION ON PLASTIC OPERATIONS OF THE EYELIDS.

Papers by—

H. Delf Gillies 70
C. Higgens 100
Derwent Wood 102
T. Harrison Butler 107

IV. DISEASES OF THE CONJUNCTIVA.

1. "Suture" operation for contracted socket and allied conditions. By Thomson Henderson 119

PAGE

2. Papilloma of the conjunctiva. By M. L. Hepburn 124
3. Case of epibulbar sarcoma cured by removal and the application of radium. By E. Treacher Collins 125

V. REPORT OF THE COMMITTEE ON "THE CONDITIONS AFFECTING THE STANDARD OF VISION IN THE BRITISH ARMY." 130

VI. CONGENITAL ABNORMALITIES.

1. A case of cryptophthalmos. By Walter Sinclair 142
2. Congenital anterior synechiæ with buphthalmos and pupillary membrane. By M. S. Mayou 146

VII. DISEASES OF THE CORNEA.

1. Bilateral superficial symmetrical opacities of the cornea of unknown origin. By D. V. Giri 147
2. Corneal degeneration. By M. S. Mayou 148
3. Purulent ring infiltration of the cornea following "mustard gas." By M. S. Mayou 149

VIII. DISEASES OF THE UVEAL TRACT.

1. Herpes zoster affecting the ciliary nerves. By G. W. Thompson 152
2. Peripapillary swelling (?) angioma. By Stroud Hosford 158
3. Ring sarcoma of optic papilla (endothelial sarcoma). By Stroud Hosford 160

IX. DISEASES OF THE RETINA AND OPTIC NERVE.

1. Bilateral multiple angiomata of the retina. By E. Treacher Collins 165

PAGE

X. DISEASES AFFECTING THE CENTRAL NERVOUS SYSTEM ASSOCIATED WITH OCULAR CONDITIONS.

1. Paralysis of ocular muscles. By James Taylor 168
2. Papillœdema and allied conditions. By Leslie Paton 170
3. Two cases of "epidemic stupor" with ophthalmoplegia. By F. E. Batten 172
4. Case of sympathetic paralysis, associated with cervical rib. By M. S. Mayou 178
5. Case of monocular traumatic altitudinal hemianopsia. By J. Gray Clegg 179
6. Case of double homonymous lateral hemianopsia. By J. Gray Clegg 182
7. A case of myotonia atrophica, with a family history of cataract. By Kinnier Wilson 183

XI. PERIMETERS AND PERIMETRIC OBSERVATIONS.

1. On a new form of scotometer, and on a sign elicited by its use. By R. H. Elliot 185
2. Large perimeter with eccentric system of registration. By A. C. Hudson 213

XII. INTRAOCULAR TENSION.

1. An experimental investigation as to some of the effects of hypotony in rabbits' eyes. By E. Treacher Collins 217
2. The histology of the trephined disc in glaucoma operations. By R. H. Elliot 227

XIII. MISCELLANEOUS.

1. A further note on the visor. By R. R. Cruise 250
2. The dioptric mean in myopia, with special reference to military requirements. By W. Wallace 254

PAGE

3. Vision and work. By Freeland Fergus 260
4. Suggested clinical tests of the threshold of light and colour. By George Young 279
5. Note on the use of glare glasses. By G. McPherson 282

XIV. APPENDIX AND MUSEUM SPECIMENS 285

Report of Council 286
Balance Sheet 288

OXFORD OPHTHALMOLOGICAL CONGRESS, 1918.

1. Opening address. By S. Stephenson 289
2. The Doyne Memorial Lecture.—Ophthalmology and the war. By Sir William Collins, K.C.V.O. . 292
3. Some aspects of military ophthalmology. By S. Hanford McKee (Canada) 324
4. On entoptic vision.—A new entoptiscope. By Sir W. F. Barrett, F.R.S. 349
5. Some observations on herpes zoster ophthalmicus. By R. H. Elliot 351

MIDLAND OPHTHALMOLOGICAL SOCIETY, 1917–18.

1. The treatment of ulcus serpens of the cornea. By A. B. Cridland 363
2. Statistics of glaucoma operations. By T. Harrison Butler 368
3. Three cases of hereditary cortical cataract, with a chart showing the pedigree of the family in which they occurred. By A. B. Cridland 375

Index 377

LIST OF PLATES.

PLATE.		FACING PAGE
I.	Fig. 1. Purulent ring infiltration of the cornea following "mustard gas." (M. S. Mayou.) (Page 149) . .	148
	Fig. 2. Corneal degeneration. (M. S. Mayou.) (Page 148) . .	
	Fig. 3. Bilateral multiple angiomata of the retina. (E. Treacher Collins.) (Page 165) . . .	
II—V.	Figs. 1–8. An experimental investigation as to some of the effects of hypotony in rabbits' eyes. (E. Treacher Collins.) (Page 217) .	218, 221
VI—IX.	Figs. 1–4, 6–13. The histology of the trephined disc in glaucoma operations. (R. H. Elliot.) (Page 227)	230, 234, 238

LIST OF DIAGRAMS, ETC., IN TEXT.

FIG.		PAGE
1—27.	Plastic operations of the eyelids. (H. Delf Gillies) . . .	73—78, 80—99
28, 29.	Masks for facial wounds. (Derwent Wood)	104, 105
30.	A case of cryptophthalmos. (Walter Sinclair)	143
31.	Ring sarcoma of optic papilla (endothelial sarcoma). (Stroud Hosford) . .	161
32.	Case of monocular traumatic altitudinal hemianopsia. (J. Gray Clegg) . .	180
33—50.	On a new form of scotometer, and on a sign elicited by its use. (R. H. Elliot)	186—188, 190, 192, 193, 195, 199—208
51.	Large perimeter with eccentric system of registration. (A. C. Hudson) . . .	214
52.	An experimental investigation as to some of the effects of hypotony in rabbits' eyes. (E. Treacher Collins) . . .	219
53.	The histology of the trephined disc in glaucoma operations. (R. H. Elliot) . .	231
54.	A further note on the visor. (R. R. Cruise) .	251
55, 56.	Statistics of glaucoma operations. (T. Harrison Butler) . . .	372, 373

REPORTS.

I. PRESIDENTIAL ADDRESS.

By E. Treacher Collins.

Gentlemen,—As the members of our Society now assemble together only once a year, I think it is well that at the commencement of each congress your President should come before you as a "prologue" and present to you an account of what has transpired in connection with the work of the Society since the last session. Our Society is not one which awakes into activity for three days in the year and remains dormant for the remaining 362. All those who have held office in connection with it know that matters are constantly arising of ophthalmological interest calling for its vigilance and care.

Immediately after the annual congress terminates the publication of its *Transactions* has to be taken in hand —a by no means light task for our Surgical Secretary. I think we may congratulate him and our publishers on having, in spite of many labour difficulties, had last year's volume ready for distribution early in November.

You will have noticed that this volume has, like so many of us as an outcome of the war, had to tighten its belt. It is considerably reduced in bulk, due to the thinness of the paper. I am, however, pleased to say it is only superfluous matter with which it has had to dispense, the number of its pages and the amount of interest in its material being well up to the average.

On the establishment of the *British Journal of Ophthalmology* some arrangement became necessary in connection with the publication in it of communications which have been read before this Society. The Council felt it was not desirable to prevent members who wished obtaining for their communications an increased and earlier publicity than our *Transactions* are able to afford. At the same time it is neither satisfactory nor useful to have the *Journal* and the *Transactions* mere reproductions of one another. In order that the Society and the *Journal* should work harmoniously together, aiding and assisting one another for the furtherance of the best interests of British ophthalmology, the following plan of procedure has been drawn up, and approved of, both by the Council of our Society and the Executive Editorial Committee of the *Journal:*

(1) As the Ophthalmological Society has a bye-law which says, "All communications accepted by the Society become the property of the Society," any manuscript or drawing of a communication made to the Society used by the *British Journal of Ophthalmology* must be returned to the Society intact and in good order.

(2) That no invitation be addressed to the opener of a discussion at the Society for the publication of such opening paper in the *British Journal of Ophthalmology*, it being undesirable that the opening paper of a discussion should appear apart from the subsequent debate.

(3) As many papers are capable of abbreviation without loss of interest to the general reader, though it is essential that they should be published *in extenso* as matters for reference, it is suggested that the *British Journal of Ophthalmology* should, when possible, publish a somewhat abbreviated copy of papers read at the Ophthalmological Society, a footnote being inserted to state that a full copy will appear in the *Transactions*. In inviting authors of such papers to insert them in the *British Journal of Ophthalmology*, it is suggested that the invitation should read, "To allow publication of a possibly somewhat abbreviated copy," or words to that effect.

(4) That when the *Journal* publishes a paper which is the property of the Society it should supply the Society with a copy of the corrected proof. Reprinting from such a proof will save the Society expenditure in the correction of printers' errors.

(5) If the *Journal* inserts any illustrations or diagrams in connection with papers which are the property of the Society, it should allow the Society to purchase electros of the blocks employed.

During our last session two resolutions were passed. The first, in connection with Capt. Cruise's paper on "Protection of the Eyes in Warfare," was as follows:

"The Ophthalmological Society of the United Kingdom, having examined the steel visor devised by Capt. Cruise, has good reason to believe that it would prevent at least 50 per cent. of all eye injuries received in warfare.

"The visor has already received the strong approval of ophthalmic surgeons in the field and at home.

"This Society respectfully begs to urge that the production of the visor should be expedited, and that its application and method of use should be placed under the supervision and control of a competent expert authority."

This resolution was forwarded to the War Office; the outcome of it, and the results of further experience of the visor, will be brought before you by Capt. Cruise in the paper he is reading on the subject this morning.

The other resolution passed was in connection with Capt. Wallace's paper on "Conditions affecting Standards of Vision in an Army." It was proposed by Dr. Mackay and seconded by Mr. Bickerton—"That the Council be and is hereby requested to consider and report to the Society on the conditions affecting the standards of vision in the British Army, with the ultimate intention of submitting recommendations to the War Office for the more efficient control of the ophthalmic department of the medical service."

The Council considered this matter of such supreme importance that they determined to appoint as strong a

committee of the Society as they could to deal with the subject. The names of those who were selected are as follows: Capt. Cruise, Col. Lister, Dr. Mackay, Mr. McMullen, Major Ormond, Capt. Parsons, and Mr. Holmes Spicer. The committee at their first meeting paid me the compliment of asking me to act as its chairman. In referring the matter to this committee the terms submitted by the Council were as follows:

"To consider and report to the Society on the standards of vision desirable for the performance of different duties in the British Army."

The report of the committee was sent in to the Council with the recommendation that it should be published forthwith in the *British Journal of Ophthalmology*. The Council agreed to this suggestion, and you will have seen the report in the January number of that publication. It will be read and open for you to discuss this afternoon. I may, however, now mention that since the committee drew it up two important developments have taken place bearing on the object which the Society had in view when it passed its resolution. The first is that the medical examination of recruits has been transferred from the War Office to the Ministry of National Service, who drew up fresh standards of vision for recruits, closely approximating those formulated by our committee. These were in operation for a time, but have since been replaced by lower standards. The second is that the War Office has recently created the new post of Consulting Ophthalmic Surgeon to the Forces at Home, and have selected to fill it one of those who served on our committee. I am sure we shall all most heartily congratulate Col. Parsons on being appointed to this important and most responsible post.

At our last annual congress most of us probably thought that when we assembled again this year we should be tuning our pipes in a time of peace; as, however, the war continues, the chief aims of this Society must still be to render whatever aid it can to our fighting

forces, and to consider how best to relieve the sufferings which the war involves. It is with these aims in view that the Council has made its selection of the subjects for discussion at this meeting. Most of us have of late been called upon to exert our ingenuity and skill to mitigate the disfigurement and discomfort caused by injuries involving the eyelids. The discussion this afternoon on "The Plastic Surgery of the Eyelids" will afford us an opportunity for exchange of ideas on the subject.

Outbreaks of disease have frequently coincided with large migrations of people. Probably there has never been a time when so large a number of men have been moved about over such great distances as during the last few years. Numbers have been transferred from countries in which contagious ophthalmia is perennially rife to others in which it has only been of sporadic occurrence. Numbers of men, free from any suspicion of contagious disease of the eyes, have been sent to districts where it has been estimated that quite 90 per cent. of the population have, or have had, trachoma. These in course of time will return and mix again with their own uninfected kith and kin.

We have all read, and heard tell, what happened to the European troops who went to Egypt in the Napoleonic wars, and how they spread trachoma amongst the civil population on their return. Is anything of a similar character likely to occur again now? To what extent has the knowledge gained of the natural history of contagious eye diseases during the past century, and the upgrowth of the principles of Listerian cleanliness, helped to check the spread of these maladies? Can any collective action taken by this Society be of assistance at the present time?

These are questions which it is thought may well form matter for our consideration at the meeting which is to be held at the Metropolitan Asylums Board Ophthalmia School at Swanley to-morrow morning.

Now that the war has lasted for nearly four years, it may not be premature to take into consideration the

prospects of matters of ophthalmic interest in after-war conditions. To turn for a while from the processes of destruction and contemplate those of reconstruction.

One impulse which has arisen amongst us as the outcome of the war, is a desire for co-operation against common foes and an avoidance of waste of energy in competition amongst ourselves.

Amalgamations, pooling of interests, and re-organisations are to be heard of on all sides. We ophthalmic surgeons, thanks to the energy and foresight of our late President, Mr. Jessop, are already experiencing the advantages of the fusion of three ophthalmic journals of uncertain stability into one well organised, financially sound, periodical.

I am glad now to be able to announce to you a further step in the direction of helpful co-operation against ignorance, disease, and superstition, which this Society has been able to effect in the course of the past year. You will remember that at our last annual meeting we so altered our rules as to enable us to become affiliated with other ophthalmological societies in the British Empire.

The Oxford Ophthalmological Congress, the Midland Ophthalmological Society have already entered into relations of affiliation with our Society, and other societies have the matter under consideration.* In becoming so affiliated the autonomy of the affiliating society is not in any way affected, and it is invited to send a representative to act on the Council of our Society. One of the chief advantages which this affiliation will bring about, apart from the general good feeling it will help to create, is that an account of the proceedings of all the affiliated societies will appear in our annual volume of *Transactions*, so that in future members of our Society will receive, not only the transactions of our

* Mr. Clogg subsequently announced that the Northern Ophthalmological Society desired to become affiliated. The Ophthalmological Society of Egypt has passed a similar resolution.

own annual congress, but also the transactions of all our affiliated societies.

This Society has from its very commencement devoted much of its time and attention to ophthalmological matters in which the public welfare is concerned. It has sent recommendations and deputations to Government departments and other public bodies, and has also had questions for its consideration and advice referred to it by them. Matters of this description are in the future likely to increase, both in number and importance. The visual tests for the performance of different duties in the public service, or for the granting of licences entitling persons to carry on occupations in which defect of sight might prove injurious, are still far from satisfactory. Blindness from ophthalmia neonatorum, a preventable disease which is curable without defect of sight, is still far too frequent in this country. Though much has been done of late years for the care of children's eyesight during the unnatural strain to which it is exposed in the course of education, further efforts in this direction are required, especially in the provision of special curricula for those who are short-sighted or whose vision is in other ways impaired. The damage to eyesight or discomfort caused in various industrial occupations from deficient, excessive, or unsuitable illumination has received much attention but will require further investigation and consideration.

The perfunctory attendance by a student for three months in the ophthalmic out-patient department of a general hospital, without necessarily any subsequent test by examination of the amount of knowledge he may have acquired, should no longer be regarded as an adequate training in eye diseases for a medical practitioner. The example of Ireland, where an examination in ophthalmology is required before a qualification to practise is granted, might well be followed by other parts of the kingdom. A great service might be rendered to ophthalmology if Universities and Colleges would follow the example of

Oxford, and establish higher examinations in ophthalmology for those who desire a diploma indicating that they have attained a degree of proficiency in this special subject. Such higher examinations would tend to stimulate the study of the scientific subjects upon which the practice of ophthalmology should always be based; whilst the possession of the diploma would afford some justification for a man styling himself an "Ophthalmologist," a title which at the present time is often assumed for the most inadequate reasons.

The Council of this Society was contemplating the formation of a special standing committee to which the consideration of questions of this and a similar sort might be referred, when the proposal came before it to form a joint committee, composed partly of members nominated by the Society and partly of members nominated by the Section of Ophthalmology of the Royal Society of Medicine; a proposal which is to be considered by a special meeting of ophthalmologists this afternoon. As it is one which seems likely to promote a concentration and uniformity of effort, which is of the greatest importance in dealing with public bodies, it has met with your Council's support and approval.

In conclusion, I have two pleasing announcements to make to you. The first is that our esteemed colleague and ally, Dr. Morax, of Paris, has accepted the Council's invitation to deliver the Bowman Lecture in 1919. The other is that the Edward Nettleship Prize, a Gold Medal for the encouragement of scientific ophthalmic work, the custody of which is entrusted to this Society, is on this occasion presented for work which has been the direct outcome of the war, and for the first time since it was established, to a physician. It is awarded to Lieut.-Colonel Gordon Holmes, C.M.G., for his valuable contribution to ophthalmology during the past three years on disturbances of vision in cerebral lesions.

II. DISCUSSION ON CONTAGIOUS DISEASES OF THE CONJUNCTIVA.

Opening Paper.

Contagious ophthalmia.

By J. B. Story.

Contagious ophthalmia excites our interest at the present time, because of the military or Egyptian ophthalmia which spread over Europe during and after the Napoleonic wars at the end of eighteenth and beginning of nineteenth century.

This epidemic ophthalmia is what is now termed trachoma, and it was introduced into Europe undoubtedly by the French and English troops returning after Napoleon's campaign in Egypt. It spread from them to the home troops and to the civil population, until, in the course of time, no country or nationality in Europe escaped the epidemic.

We all know now that trachoma is a specific contagious disease: this was not always recognised. To their credit, be it said, the English Army surgeons in Egypt and elsewhere almost unanimously held this view from the first, but the French, on the contrary, regarded the disease as a catarrhal ophthalmia of abnormal severity, and not contagious, being due to such agents as climate, blinding sun and heat of day, damp cold winds at night, sand, etc. For the first thirty or forty years of the nineteenth century these points were subjects of controversy in ophthalmological literature all over Europe.

We all are pretty well agreed now upon the following

points, that a disease was endemic in Egypt before the Napoleonic wars, and that it was an ophthalmia of the same nature as broke out in Europe on the return of the troops from Egypt to their homes in Europe. That no such epidemic of ophthalmia occurred during the wars of the eighteenth century. Ophthalmia existed among troops in former wars, but never to such an extent as to affect such numbers of soldiers (about two-thirds of the French troops shortly after landing in Egypt were affected) and civil population.

There is a danger that epidemic ophthalmia may occur again after the present world-war.

In Ireland trachoma has been prevalent in the nineteenth century. Special wards had to be reserved for it in the hospital founded by Sir William Wilde in 1854, and the hospital had on several occasions to be closed in consequence of epidemics of ophthalmia breaking out in the other wards.

Towards the end of the century trachoma decreased in Ireland so far as my personal experience goes, but in later years it has increased again. Most of the credit for this later increase is to be given to the American doctors, who inspected all immigrants to the United States at the Irish ports, and remorselessly refused embarkation to any with even doubtful signs of trachoma. Consequently, large numbers of most undesirable aliens were left stranded in Ireland—whole families, perhaps, from far regions of Eastern Europe, and trachoma accordingly became more prevalent in this country.

The members of the medical profession in the United Kingdom should endeavour to obtain from our Government the enforcement of such elementary sanitary regulations as are adopted in the United States to prevent the spread of contagious diseases in this kingdom.

Opening Paper.

An historical note upon the development of the ophthalmia school.

By S. Stephenson.

I have been asked to trace the history of the various steps that have culminated in the institution of the Swanley Ophthalmia School, and this I have the greater pleasure in doing since I was personally associated with some of the more important of them.

Although the several ailments of the eye comprised in the generic word "ophthalmia" were doubtless contemporaneous with the bringing together of large numbers of poor and often diseased children in workhouse and so-called district schools, yet the impetus to collective treatment was first given by a report based upon an examination of the eyes of the inmates of the Central London District School at Hanwell, addressed by the late Mr. George Critchett to the Guardians of the City of London (*City of London Union: Report of Special School Committee of Guardians upon the General Arrangement and Management of the Central London District School at Hanwell*, 1868, p. 14). Mr. Critchett recognised that the disease under discussion owed its formidable aspect to three circumstances: (1) it was protracted and persistent; (2) it was apt to relapse when apparently cured; and (3) it was liable to communicate a similar disease to other children, often in an acute and severe form. In order to cope with this state of things two expedients might be adopted: first, to scatter the affected children among their friends, supposing they had any; or, secondly, to place them in the school infirmary. "I would treat the inmates of the infirmary," wrote Critchett, "the same as if they were in school; I would have regular instruction and the same rules and discipline as the school, and I would keep them there until they were either completely

cured or until they left." The advantages of this plan were obvious: (*a*) the education of the affected children would not be neglected; (*b*) there would be no necessity for hurrying convalescent children back to the school; (*c*) the infirmary would cease to be an attractive place for the inmates, and this would render the artificial generation of the disease less common; and (*d*) it would safeguard the school against the intrusion of infective material capable of inoculating the other children.

Mr. Critchett's eminently sane advice, although not adopted by the authority to which it was given, was put into operation in 1873, when some 300 to 400 children, affected with various degrees of ophthalmia, were drafted from the North Surrey District School at Anerley to the new and unoccupied Whitechapel Workhouse in the Mile End Road, where they were placed under the direct charge of the late Mr. Edward Nettleship, assisted by a staff of nurses, teachers, and other officers. This combined infirmary and school was carried on for one year. But, in recounting the results, Mr. Nettleship wrote: "Any scheme of this kind in future would require a term of three or four years for its completion instead of only six or twelve months" (*Report on Ophthalmia in the Metropolitan Pauper Schools,* 1874). The chief value of the Bow Branch School (as the institution was called) lay in showing that Mr. Critchett's suggestion was a thoroughly practical one.

The Brentwood School, at that time belonging to Hackney and to Shoreditch, adopted a similar policy in 1883, when about ninety patients with ophthalmia were sent to a small, separate school, some three miles away. Isolation was kept up for two years—in fact, until the unions named dissolved partnership. During this time the education of the patient was, by no means, neglected.

The next step to be noted concerned the schools of the parish of West Lambeth, situated at West Norwood. They had gone through a stirring experience as regards ophthalmia. Here we need merely say that a serious

outbreak of the acute disease occurred in June, July, and August, 1886, and affected mainly the younger children. It followed measles imported into the school during the preceding months by children from the workhouse, who were allowed to enter without preliminary detention in the probation wards. The guardians became alarmed, and, acting under medical advice, drafted all affected children to the parochial infirmary in Kennington, where proper classification and isolation were out of the question. The results were not long in showing themselves. The virulence of the disease became enhanced, and eyes were damaged or actually lost. The malady spread apace; infected children who had never been in the schools; spread to adult patients; and did not spare even the nurses and others employed about the children. In short, the disease well-nigh disorganised the administration of a large and important London Poor Law infirmary. At this stage (November, 1886) my services were requisitioned. As a first step the cases of ophthalmia were sent to Norwood, where they were lodged in the school infirmary, a detached and self-contained building, capable of housing 108 children, and of giving to each bed some sixty square feet of floor space. An adequate staff of nurses was provided. I was asked to assume medical charge of the children. Owing to the position of the infirmary, efficient isolation offered no difficulty. Teaching was in the hands of a resident governess, which implied that the respective school standards occupied by the children when in health could no longer be maintained in their full integrity. Much of the teaching was carried out in a large field conveniently situated as regards the infirmary. Meanwhile, the presumably healthy inmates of the schools were examined with regard to the state of their eyes, and a considerable amount of disease was found to exist among them. For example, among 416 of the older boys and girls lodged in the senior school 14·59 per cent. were found to suffer from trachoma. They were segregated in the infirmary under my charge.

During my stay at Norwood some notable improvements were effected in the administration of the schools. Thus, a quarantine of fourteen days was imposed upon every new-comer, and all cases of ophthalmia were refused admission; the jet system of washing was introduced; steps were then taken to keep the children in the open air as much as possible; and last, but not least, the non-resident medical officer, whose energies had been paralysed by failing health, was superannuated and replaced by a medical man, who devoted his whole time to the work of the schools. The number of those separated for ophthalmia gradually dwindled from 22·77 per cent. of the total school population on October 22nd, 1887, to 5·78 per cent. on September 15th, 1888, and my connection with the Norwood schools ceased in the last-named month, my services having been retained for a period of nearly two years. The medical administration then devolved upon the resident medical officer, who had been closely associated with me during the last few months of my term of office.

While the Norwood experiences were in the making, ophthalmia had given cause for anxiety in the Forest Gate District School at East Ham. In May, 1888, it was found that a considerable number of the infants were affected with "granular lids," and, acting upon the advice of the late Dr. J. H. Bridges, then Local Government Board Inspector, the managers appointed Mr. Herbert Parker (a trained ophthalmic surgeon) to take charge of all affected children during which time he was resident in the school. Toward the expiration of that period Mr. Edward Nettleship was requested by the managers to examine the eyes of the inmates, and he characterised the state of affairs as being "a great improvement on the condition six or eight months ago," but insisted strongly upon the necessity of isolating, until quite well, every case of "granular lids."

The largest experiment of all has yet to be mentioned, namely, that carried out at the Central London District

School at Hanwell, a building certified for the reception of 1311 inmates. That institution had enjoyed an unenviable notoriety in the matter of ophthalmia since its inception in 1849.* Over and over again had the advice of experts been asked (and one must, in candour, add disregarded) as to the best means of eradicating the scourge. Mr. Bowman, in 1858, and Mr. Haynes Walton, in 1861, made reports. In the early part of 1862, what seems to have been purulent ophthalmia broke out in the school. Among 300 cases among the younger boys, seven eyes appear to have been lost. Mr. Bowman was again consulted; and the epidemic was considered to be of so serious a character that five doctors, in addition to the resident medical officer, were specially engaged to cope with it. During that eventful year Mr. Bowman made ten reports in all. In 1868, as already noted, Mr. Critchett proferred that advice which has now happily become *un fait accompli*. In 1874, when Mr. Edward Nettleship made a systematic inspection of the eyes of all inmates of the Metropolitan Poor Law schools, Hanwell figured prominently upon his black list. Not 15 per cent. of the eyes could be described as healthy (*Report on Ophthalmia in the Metropolitan Pauper Schools*, 1874). In 1888, the late Dr. S. G. Litteljohn, then resident medical officer to the school, entered fully into the question, upon which he brought to bear the lengthened experience of the disease which his eighteen years' connection with the institution had afforded him (*Report of the General Purposes Committee on Ophthalmia, with Report of S. G. Litteljohn on same subject*. London: Ash & Co., 42, Southwark Street, S.E., 1888). "Children have contracted the disease in the school . . . to an appalling extent," wrote Litteljohn. "Hundreds of eyes admitted healthy have

* The School District was instituted in 1849, and the original premises were at Westow Hill, Norwood. In 1856 the present site of one hundred acres at Hanwell was bought for £12,600, and the school was erected at a cost of £45,200. There appears to be no doubt that ophthalmia was brought to Hanwell by children from the original school at Norwood.

been attacked here, and it is useless and would be cowardly to attempt to deny or conceal it." It is not going too far to say that the questions asked by Mr. Mundella in the House of Commons (May and June, 1889) and by the Earl of Strafford in the House of Lords (June, 1889) were inspired by Littlejohn's candid, outspoken, and fearless report. Another consequence was that my services were engaged exclusively to attend to the ophthalmia cases. The necessity of erecting an isolation school in which all affected children could be tended, taught, and treated, which had been repeatedly urged upon the managers, had been rejected by them, but I made such a provision an indispensable condition of my engagement. Accordingly, at a meeting in June, 1889, the school managers determined to erect the necessary buildings on a piece of ground, some eleven acres in extent, adjoining the south side of the main school at Hanwell. The new institution (which was fully described in the pages of the *Lancet* of April 5th, 1889), was commenced upon September 1st, 1890, and completed within a period of about three months. It was designed for 400 children, but, in point of fact, it was never occupied by more than about 350 patients. The cost per bed was £75. Every affected child was housed in the isolation school by May, 1890. The number of patients, as might be expected from the conditions, grew steadily fewer from year to year. In June, 1892, it had dwindled down to 101, and in the June of the following year to so small a number as 63.

Meanwhile, an opportunity had been taken to effect a great improvement in the Hanwell School itself. It was arranged upon what is termed the "barrack" system; that is to say, 92 per cent. of its inmates were housed under a common roof. It had an unbroken frontage to the north of 600 ft. in three stories. All this was changed between July, 1890, and February, 1892. Four open spaces were driven through the main block and the outstanding wings were cut loose from the frontage. It

thus became possible to lodge the children in five detached houses, as it were, separated from one another by a distance of 18 ft. Other improvements were also made. To sum up briefly the progress made at Hanwell in respect of ophthalmia, I may point out that the numbers under treatment formed in 1889 about 33 per cent. of the total school population; in June, 1893, the proportion had sunk to 7 per cent.; in June, 1895, to 1·5 per cent.; and in December, 1896, to 0·6 per cent. These figures speak for themselves, and prove, once and for all, that endemic trachoma can be practically eradicated from a large school by a patient and thorough application of common-sense principles, based upon the isolation of affected children and the universal application of the rules of sound hygiene.

As already noted, in June, 1893, the wards of the isolation school, originally intended for the accommodation of 400 children, were occupied by 63 patients only. In that year the managers agreed, upon my suggestion, backed as it was by that of the Whitehall authorities, to admit ophthalmia patients from other unions, parishes, and school districts at a charge of so much a child per week. The arrangement was found to work smoothly. It was, indeed, continued with the happiest results until it merged in the Metropolitan Asylum Board scheme in 1903, when the Hanwell patients were transferred to Swanley. The Hanwell experience showed conclusively that (1) a central isolation school was no mere Utopian dream; (2) efficient medical treatment could be carried out without hampering the education of the children; (3) the various parochial authorities were ready to avail themselves of the services of such an institution; and (4) valuable results might be expected, both as regards the Poor Law population and the advance of medical science. In brief, it demonstrated that such a scheme was perfectly practicable from an educational, a medical, and an administrative point of view.

A few more words and I have done. In February,

1896, a Departmental Committee appointed in 1894 to inquire into the existing systems for the maintenance and education of Poor Law children, before which I had the honour of giving evidence, endorsed the proposal to establish one or more hospital schools for the reception of those suffering from ophthalmia, and further recommended an inspection of the inmates of every metropolitan infirmary, workhouse, and school with a view to singling out the children in need of isolation on account of that disease. Soon after the appearance of that report, I was asked by the Local Government Board to undertake an inspection of the children for the purpose suggested by the Departmental Committee. My report dealt with 17,002 children, of whom 860 were below the age of 2 years (*The Ophthalmic State of Poor Law Children in the Metropolis*, 1897). Among the children 973, or 5·72 per cent., suffered from trachoma, and I suggested that they should be housed in a couple of hospital schools, arranged upon the "cottage" or "small block" plan, under the control of the Metropolitan Asylums Board, thus repeating the advice given by me in the columns of the *Lancet* on January 14th, 1893. This has now been accomplished, and you have to-day an opportunity of appreciating the results, both medical and otherwise, in the institution that has so generously thrown open its doors to your meeting.

Opening Paper.

By J. F. Cunningham and J. Wharton.

We propose to limit ourselves to contagious diseases of the conjunctiva in war-time, and to discuss the various methods of isolation and treatment that were adopted to meet the exigencies of the military situation in France.

The problem presented to us arose on the introduction of the coloured labour units into France, and we had

mainly to deal with trachoma and to a lesser extent with conjunctivitis.

The dangers of trachoma, as instanced by its synonym, military ophthalmia, are well known to every one here, and I would refer any one who wishes statistics of the havoc it has wrought in armies to the graphic story unfolded in our admirable English translation of Boldt's *Trachoma*.

The trachoma problem we have had to face has been a large one. Several thousand Egyptians, of whom 19 per cent. had active trachoma, and many thousand Chinese, of whom 9 per cent. had active trachoma, had to be examined. The infected cases had to be weeded out from the clean cases, and isolation and treatment had to be arranged for.

We have no knowledge of the disease spreading in any instance to the civil population or to our own troops.

The individual cases are improving under treatment, and the number of hours lost from sickness per week in a trachoma company is no more than that in a clean company.

The first Egyptian company was seen on the day of arrival by Capt. W. Stirling, the ophthalmic specialist of the area, who reported that there were a number of cases of active trachoma in the unit. On the next day 100 men were examined by Col. Lister, who notified the presence of the disease to the authorities.

On May 7th, 1917, we held a consultation with Col. Sir W. B. Leishman, K.C.M.G., C.B., F.R.S., and Lieut.-Col. W. W. O. Beveridge, C.B., D.S.O. It was agreed that the matter was important, and it was decided that a complete examination of the Egyptians and Chinese should be made in order to determine what proportion of the units of the two nationalities were affected.

In order to limit and to prevent as far as possible a further introduction of cases of trachoma into France, the following telegram was despatched : "That no cases with definite trachomatous granulations or any acute conjunc-

tivitis should be allowed to embark from Egypt or China or disembark in this country."

Instructions were issued for examinations of the men before enlistment and on disembarkation by medical officers who had experience of trachoma. The lids were to be turned in every case, and affected men were to be rejected.

In the course of a week we examined 3847 individuals, everting both upper lids. Of these there were 2417 Egyptians and 1430 Chinese. We classified them into (1) infectious; (2) non-infectious; and the non-infectious were divided into those who had had the disease but in whom it was now quiescent, and those who were quite free.

The following were our results:

Egyptians.

Number of men examined, 2417.
Active trachoma, 390 . . . 16 per cent.
Signs of old trachoma, now quiescent 29 „

(*i.e.* 45 per cent. of the men had or had had trachoma; 2 per cent. of the trachoma cases were acute cases.)

Chinese.

Number of men examined, 1430.
Active trachoma, 68 . . . 4·7 per cent.
Signs of old trachoma, now quiescent 2·3 „

(*i.e.* 7 per cent. of the men had or had had trachoma; 0·9 per cent. of the cases of trachoma were acute cases.)

Some form of isolation and treatment was obviously necessary as soon as possible.

Our objects were to keep the men fit to work and

(1) To prevent the spread of the disease
  (*a*) To the civil population.
  (*b*) To our own white troops.
  (*c*) To those in these native units at present unaffected.
(2) To prevent the impairment of sight of those

already affected, and to ameliorate the condition of the individual patients.

Col. Lister urged in his report

(1) That practically all the infected cases were quite fit to work.

(2) That treatment would not prevent their working.

(3) It was also pointed out that treatment would be compensated for by the increased efficiency of labour.

It was clearly stated that a cure was not guaranteed, and that it was not the main object of treatment.

The following recommendations were also made:

(1) That the number of centres to which affected men were sent should be limited, in order that segregation and treatment might be properly carried out, for if batches of men were disseminated broadcast over Northern France special treatment and supervision would be practically impossible.

(2) That the camps for both Egyptian and Chinese labour companies should be enclosed.

(3) That the men should not be allowed out of their camp except for work.

(4) All linen in infected camps should be disinfected before it is sent out to be washed—*e. g.* towels, handkerchiefs, etc.

(5) Chinese and Egyptians should work in gangs by themselves, and not in association with other units. The disease, being contagious and not air-borne, the risk of spreading it while at work is practically negligible with such occupations as unloading ships, digging, etc.

These regulations were made with a view to preventing the spread of the disease to our own men and the civil population.

In legislating to prevent the spread to unaffected men in these units, the obvious course was to form trachoma companies and clean companies. In the case of the

Egyptians we were at once faced with this difficulty. The men had been enlisted in Egypt by their own Rais in groups of varying numbers. They looked up to and depended upon this man, and in practice it was found they could not be separated from him. In the case of the Egyptians, therefore, whose stay in France was to be shorter, we had to be contented with segregation, disinfection, and treatment within each company. Although there were different problems to be faced with the Chinese, this was not a difficulty in their case.

In order to prevent trachoma spreading to the unaffected in the various units, the infected were put into special huts or tents, and were given separate ablution quarters. This was usually done by partitioning off a part of the ablution hut for their exclusive use. The affected men's blankets, clothes, towels, and basins were marked, and a large red "T" was painted on the upper part of each sleeve, both of the coats and smock. This was considered more reliable than a badge, which could be removed should the patient feel disposed to alter his category.

The extra accommodation necessary was a small treatment tent or hut and a larger waiting-room, hut, or marquee. If huts were available, a small portion of one end was partitioned off for treatment and the rest of the hut was used as a waiting-room. This accommodation was found sufficient for two companies if they were encamped side by side. Treatment had to be carried out regularly at hours that did not interfere with the men's work. In the case of the Egyptians, the tents or huts in which the affected men slept were at one end of the camp.

With the Chinese we were able to form trachoma companies in the case of the men arriving. Companies already in various areas had to be specially legislated for. In the majority of cases, trachoma companies with their officers were sent out from Chinese Headquarters under strength into areas where more labour was required, and the trachoma cases from the clean companies in the area were drafted into these companies. Some of the com-

panies were employed on special work of a mechanical nature, and it was more difficult to replace these specialists, and in these companies the transference could not take place all at once. The vacancies in these companies were made up by drafts of clean men from Chinese headquarters in all cases.

In examining the Chinese we found that the majority of the men affected had the disease in a very early stage, two or three men in every 500 would have well-marked trachoma of some standing, and the rest would be quite early cases. These early cases were very suggestive of the disease having been contracted on the voyage, when the men were of necessity more crowded together, and washing arrangements were perhaps not all that could be desired.

There were a number of cases of chronic conjunctivitis also, and it became necessary to form conjunctivitis companies as well as trachoma companies.

This preliminary examination took place at Chinese Headquarters, where the men, arriving in shiploads, were formed into companies about 500 strong, and sent out with their white officers and equipment to their various stations according to the requirements of the labour authorities.

Before joining a company each man had, in addition to a general examination, to have his lids turned. The men were classified under three headings. If the lids were healthy, and there was no evidence of any conjunctivitis, they were placed in the "X" or clean class. Those who had conjunctivitis without definite evidence of trachoma were classified as "Y" cases, and the men affected with trachoma were placed in the "Z" group.

This ophthalmic differentiation at Chinese Headquarters, which was the distributing centre for the Chinese, was instituted in July, 1917. The inspections were carried out by Capt. Stuckie and two colleagues, who were always men who had experience of the disease, and the subsequent success of the scheme is due in a large measure

to the thoroughness with which they made this initial classification. The men were sent out from Chinese Headquarters in "X" (clean), "Y" (conjunctivitis), and "Z" (trachoma) companies.

The advantage of having the "Y" companies was that it was often impossible at one examination to say whether a case was or was not one of trachoma. To put the man into a trachoma company would most probably give him the disease should he be a case of simple conjunctivitis, and if he were sent out in a clean company, and eventually proved to be a case of trachoma, he would be a possible source of infection to the whole company.

This "Y" group was the more necessary, as the majority of cases of trachoma among the Chinese were early cases, the most common form being an infection of the upper tarsal conjunctiva.

Every affected coolie had a "Y" or "Z," as the case might be, stamped on his clothing in the following way:

(1) On the top of the left sleeve of the inner and outer jacket and on his wadded jacket.

(2) On the front of the left trouser leg at the junction of the middle and lower third of the thigh on both blue trousers and wadded pairs.

All such stampings were to be done with red paint; each man's individual towel was also to be stamped.

The "Z" trachoma and "Y" conjunctivitis companies were sent as far as possible to the bases, where each group could be under the care of a medical officer with ophthalmic experience. There was some difficulty in arranging this at first, but all these "Z" and "Y" companies are now on the lines of communication, which ensures their getting thorough ophthalmic supervision and treatment.

In the course of our inspections we found that a certain number of the men in the clean companies developed a simple conjunctivitis. Many of these companies were camped on sandy soil, and the men had to work in a dusty atmosphere. Col. Lister, therefore, instituted the

"Universal Drops Treatment," that is, every Chinaman in the clean as well as in the affected companies was to have a couple of drops in each conjunctival sac once a day of—

Acid bor. . . .	gr. x
Zinc. sulph. . . .	gr. ij
Aq.	ad ℥j

These drops were to be instilled preferably on their return from work by the native medical orderly.

The men were made to squat in two rows facing each other, and to draw down the lower lids with their fingers and look upwards. The orderly, who had been instructed how to instil the drops, went round and dropped a couple of drops into each conjunctival sac; when he had finished one side he went to the other; meanwhile, the men who had had their drops were replaced by a fresh lot. In this way the whole company was treated in about twenty minutes.

An order was also issued that the Chinamen's towels should be boiled twice a week in all the companies, and for this special cauldrons were provided for each company.

The Chinaman has a peculiar affection for his towel, and we frequently saw them taking their towels with them to work, tied round their heads or over their shoulders. It is not unknown for them to loan their towels to their friends while at work. Handkerchiefs are not used by the Chinese, though some have acquired this appendage of civilisation over here.

In all affected companies the officers were to have white servants.

Provision of some sort had to be made for the men already *en route*. Medical officers were warned to look out for cases of trachoma, and the Universal Drops mentioned above were to be used on board ship.

Stated briefly, the treatment aimed at has been the simplest possible compatible with efficiency.

Expression of follicles has been done for the worst cases and copper sulphate, the solid stick or drops, has

been the mainstay in treatment. Silver salts have been used for cases with much conjunctival discharge or injection and atropine when necessary for pannus, ulceration, etc.

Transference of apparently cured cases into clean companies has not been allowed.

As an instance of how the diseases can spread if untreated, we may mention one company in which we found twelve cases of trachoma. Transference was not effected for various reasons, and eight weeks later we found fifty-nine cases.

Capt. Stuckie, who has had a large experience of the disease in China, tells us that the disease here under treatment is very much milder than it is over there.

That it may be virulent and incapacitating over here is proved by the figures of another company. This company was a trachoma company, and was sent into one of the front areas where efficient treatment could not be carried out. Some weeks later it was sent to work at a base, and came under the care of Capt. Hine. The sickness returns of this company, which Capt. Hine has kindly furnished us with, are very instructive. Out of 588 men examined October 24th, 1917, he found 68 needing expression, and there was much muco-purulent discharge amongst the men in the company. On an average, 30 men were daily off duty for eye trouble. In December 7 daily was the average off duty for eye disease, and in January–February, 1918, this had fallen to 2 daily. When the company was re-inspected by Capt. Hine in January this year he found only 8 men needing expression of follicles and 13 who needed blue-stone (as against 58 on the first inspection).

Fifteen men of this company were also sent back to the Native Hospital at the Chinese Headquarters as unfit to work before the company was moved into Capt. Hine's area.

Coming to the results obtained, we know of no case of the disease having spread either to the civil population or to our own troops. We cannot give the actual sickness

figures, but the Controller of Labour informed us that the number of men off duty in the affected companies was no greater than in the unaffected companies—*i. e.* the time lost from eye disease was practically inappreciable. We have on many occasions been told voluntarily by the non-medical company officers that the men are much better for their treatment. They do not resent treatment in any way, and, in many instances, seek it. By diminishing the discharge the men in the trachoma companies have been rendered non-infectious to those outside the unit in the course of a few weeks, and the risk of a virulent epidemic which might have spread to other units has been avoided.

The number of cases sent back as unfit to work to the Native General Labour Hospital at Chinese Headquarters does not exceed two or three a month. Some other cases are sent there, but these are only men sent from "X" or "Y" companies for redrafting, and they are all fit to work.

Lieut.-Col. C. D. Gray, the C.O. of the hospital at Chinese Headquarters, informs us that very few men have had to be repatriated. Writing at the end of March this year, he said that two men were repatriated last December and that he had another case in hospital awaiting repatriation (*i. e.* less than one man per month had to be repatriated for trachoma). Col. Gray has issued a leaflet for the white *personnel* of the different companies, which warns them of the dangers of trachoma and conjunctivitis and tells them of the necessary precautions they must observe.

We are indebted to Capt. Stuckie, who has been examining these men on arrival since July 24th, 1917, for the following figures, which give the total percentage of those with trachoma and conjunctivitis in nearly nine months:

Percentage of men with trachoma .	5·04
,, ,, ,, conjunctivitis .	13·49
,, ,, ,, eye affections .	18·53

With the more careful scrutiny of recruits the per-

centage of trachoma cases has fallen from 13 per cent. in the earliest batch examined to 3, 2, and even under 1 per cent. in those sent over later. Some idea of the incidence of the diseases in Northern China might be obtained from the complete figures of the examining medical officer there.

On one occasion the percentage of rejections for trachoma in over a thousand men was 19 per cent.; on another occasion, out of three thousand odd men examined, only 5 per cent. were rejected for eye disease.

The number of trachoma companies is now half as many again as that of the conjunctivitis companies, in spite of the fact that Capt. Stuckie's figures show that over 13 per cent. of the men had conjunctivitis against 5 per cent. only with trachoma. This is largely due to the fact that the men remained in the Chinese Hospital frequently for a week or more, and that many of the conjunctivitis cases could then be placed in clean companies.

The number of Chinese with trachoma is under 10 per cent. of the total number of Chinamen over here. Capt. Stuckie's figures show only 5·04 per cent. with trachoma since July 24th, 1917, amongst the Chinese. The Chinese, however, were coming in for over a couple of months before this date, and the incidence in the earlier companies was much higher than in the later ones.

Any case of trachoma which may develop from time to time in a conjunctivitis company is transferred to a trachoma company. The individual cases have, as a whole, improved steadily, and I think it may be claimed that the results of the measures adopted have been most satisfactory, for it must be borne in mind that all clean cases are contacts; they have been in close association with infectious cases both on their way over and after their arrival until the time of their classification into separate companies.

We have found the employment of the "Universal Drops" most beneficial; not only do they check any discharge that may be present, but they are a very useful

form of lavage for the men working as they generally have to do in dusty locations. They take very little time to instil, and a marked improvement in the condition of the eyes has been noted since they were started.

The work of inspecting and combing out the infectious cases from the various companies has involved a large amount of hard work, in addition to running the routine of an ophthalmic centre. On several days when inspecting in army areas we have, for instance, travelled a distance of some hundred miles, inspecting as many as 5000 cases in a day, and taken a complete record of the men with trachoma as well as those with conjunctivitis. We were thus enabled to place before the authorities lists of men for transfer to trachoma companies and those with conjunctivitis who would require treatment.

A system of monthly reports from the medical officer in charge of companies is being instituted, as the numbers involved render it impossible for one or two individuals to inspect the many thousands of men scattered all over the British area. The returns are to be made on cards for index filing. The medical officer will state the average number of men off duty daily in his company for eye disease, and the number, if any, sent to Chinese Headquarters as unfit to work on account of eye trouble. There are also spaces for him to make returns of the number of trachoma, conjunctivitis, healthy, or apparently cured men, as the case may be, in the company.

By this means the progress in each company from month to month can be noted at a glance, and it will be seen if the medical officer requires any help.

That the centres are working so well is very largely due to the thoroughness and conscientiousness with which the various ophthalmic surgeons in charge are doing their work. It must be remembered too that the treatment has to be carried out in the men's spare time, in order not to interfere in any way with their work.

Just over a month ago a case of trachoma was discovered accidentally in a member of one of the South

African units, and we were asked to examine the company and found some cases of trachoma. Amongst them were two or three cases with well-marked cicatrisation, which was obviously of considerable duration. This led to an examination of the whole unit, which, although a comparatively small one, was widely distributed and necessitated inspecting them at fifteen different places. The incidence of trachoma in this unit, which was only a few thousand strong, was just over 3 per cent. In this instance arrangements are being made for the affected men to work in a section by themselves near an ophthalmic centre, where treatment, etc., can be supervised.

Finally, we would like to bear testimony to the cordial co-operation of the labour authorities in the organisation and the working out of the scheme.

Opening Paper.

Military ophthalmia in Egypt: A comparison between the incidence of ophthalmia among Napoleon's troops in Egypt, 1798–1801, *and in the Egypt Expeditionary Force,* 1915–1918.

By H. L. Eason.

Most students of ophthalmic surgery are familiar with a short statement in Fuchs's *Text-book of Ophthalmology* with reference to the spread of trachoma in Europe as a result of the Napoleonic wars. For the sake of those who are not, it may be worth while to quote it:

"It was at the commencement of the last century that trachoma began to attract the attention of physicians to any great degree. It was then that the disease first showed itself as an epidemic among the European armies (ophthalmia militaris). People were of the opinion that it had been introduced into Europe from Egypt (hence ophthalmia Ægyptiaca) by Napoleon I. For when the latter, in July, 1798, landed in Egypt with an army of

32,000 men, most of the soldiers were very soon attacked by a very violent ophthalmia, and these were supposed to have brought with them, upon their return to Europe, the disease which was formerly confined to Egypt. Subsequent historical researches, however, have shown that the disease had already been endemic in Europe since antiquity. It is mentioned in the Ebers papyrus and in a pseudo-Hippocratic manuscript. Celsus gives a good description of the roughness of the lids and the purulent discharge that it occasions. For treatment, the ancients employed scarification of the conjunctiva, which is still to-day made use of by some, and which was accomplished both by means of various instruments and also by friction with fig-leaves.

"From time immemorial, then, trachoma has existed in Europe as an endemic disease. But when by reason of the Napoleonic wars the armies came so repeatedly in contact with each other and with the civil population, the disease became more widely disseminated and occurred in epidemics. In some countries it became frightfully prevalent. In the English Army, during the year 1818, there were more than 5000 on the invalid list, who had been rendered blind as a consequence of trachoma. In the Prussian Army from 1813 to 1817, 20,000–30,000 men were attacked with it; in the Russian Army from 1816 to 1839, 76,811 men were subjects of the disease. In Belgium in 1840, one out of every five soldiers was affected with trachoma. The French Army, which was supposed to form the starting-point of the disease, was just the one that, relatively speaking, was least attacked. The armies disseminated trachoma among the civil population through the discharge of soldiers affected with eye diseases, through the quartering of troops, etc. When they had so many trachomatous soldiers in the Belgian Army that they did not know what to do, the Government applied to Jungken, who was at that time a celebrated ophthalmologist in Berlin. He recommended them to dismiss the trachomatous soldiers to their homes. By means of this

fatal measure trachoma soon became diffused in Belgium to an extent that has been observed in no other European state."

In view both of this commonly accepted account of the cause of the spread of trachoma in Europe and of the prevalence of trachoma among the civil population in Egypt, there is a very general idea that there must be a great deal of ophthalmia among the troops in Egypt, and everyone seems to be impressed with the virulence of trachoma and its great danger to our Army. It is not without interest therefore to contrast the conditions among the Napoleonic troops in that famous but ill-fated expedition to Egypt in 1798–1801 with our experience in the Egypt Expeditionary Force of 1915–1918.

I have not had the opportunity or the means of checking the statements made by Fuchs or of consulting the authorities from whom he derives his information, but I have been able to consult the original accounts of the diseases which affected Napoleon's troops; these are described in great detail and in picturesque language by his famous surgeon-in-chief, D. J. Larrey, afterwards made a Baron of the First Empire and Senior Surgeon to the Emperor Napoleon's Old Guard.

A copy of Larrey's work, *Mémoires de Chirurgie Militaire et Campagnes* (Paris, 1812), is in the library of the Kasr-el-Aini Medical School at Cairo, with a dedication in his own handwriting: "Offert au premier médecin de S.A. le pacha d'Egypte, hommage de l'auteur, D. J. Larrey."

It is from this source that I have derived my account of the outbreaks of ophthalmia which so ravaged Napoleon's Army.

Larrey was appointed surgeon-in-chief to Napoleon's Egyptian Expeditionary Force in 1798. He says that, realising the importance of being made surgeon-in-chief to an expeditionary force of 30,000 soldiers, his first step was to collect a medical staff, which he did by writing to the Schools of Medicine of Montpellier and Toulouse. By this means he collected 108 medical officers.

Before leaving Marseilles he gave them a preliminary course of instruction, and collected, as far as he was able, a full equipment of medical stores and instruments. The expedition left Marseilles on May 13th, 1798, and arrived at Toulon on May 19th. From Toulon it took twenty-one days to reach Malta, where the Army disembarked on June 10th. They left Malta on June 18th, and arrived, twelve days later, before Alexandria, which was stormed and taken next day. In this action General Kleber was wounded, and he was subsequently left behind in command of the garrison which remained at Alexandria. On July 6th Napoleon, and with him Larrey, started out for Cairo. To use Larrey's own words :

"The Army set out without provisions and without water, into the arid deserts which border Lybia, and only arrived with the greatest difficulty, on the fifth day of the march to the first place in the interior of Egypt offering any resources, Damanhour. Never has an army had to endure such privations or undergo such dangers. Stricken by the rays of a burning sun, marching on foot on sands still more burning, crossing immense and dusty plains, where there were to be found only a few ditches of muddy water, almost solid, the hardiest soldiers, consumed by thirst and heat, succumbed under the weight of their equipment."

Napoleon reached the Nile at Rahmaneah, and, proceeding by the left bank of the Nile, reached Chebreissa on July 13th. A further march, then the battle of the Pyramids near Embabeh, a suburb of Cairo, and on July 25th Napoleon took possession of Cairo and of the Citadel. Larrey then went off to the Sharkieh Province, with Napoleon in pursuit of Ibrahim Bey, and on his return to Cairo, a few weeks later, heard the news of the Battle of the Nile, at Aboukir, and of its disastrous results to the French Fleet. On his return to Cairo he organised the surgical service, and formed in the principal hospital a school of practical surgery for the young surgeons in the Army. In his own words, writing in 1812 :

"I supervised with care the treatment of the wounded and of those affected by diseases of the eye, for ophthalmia had already appeared and commenced to spread (it was the time of the overflow of the Nile). Desaix's Division, which remained a long while embarked on this river in Upper Egypt, furnished the greater number of cases of ophthalmia. The physicians and surgeons who had to treat this disease were not in agreement as to the causes which produced it or the means it was necessary to employ to deal with it. The quacks, who practised in the country, pretending that they alone understood an affection due to their climate, imposed on the credulity of many soldiers who were attacked, and this caused many of them to lose their sight. These considerations led me to publish, on the subject of this malady, a memoir which I addressed to my colleagues, the senior surgeons, to define the treatment by which it was necessary to deal with the disease, and this I communicated to the Institute of Cairo. I am now offering the contents of the memoir, with some additions I have had occasion to add subsequently. The principles which it embodies were put into practice after publication, with so much success that these diseases became in consequence, even in the hands of junior medical officers, most simple and easy to treat."

After some prolonged stay in Cairo, Napoleon started for Syria on February 9th, 1799, and marched first into the Sharkieh Province. After the battle of Salhieh, on the eastern edge of the Delta, Larrey went with a company of Camel Corps to El-Arish to join the advance guard and to look after some casualties which had occurred in the attack on El-Arish itself. On February 28th Napoleon arrived at El-Arish, and started for Syria, passing through places whose names are familiar to all who have fought their way across Sinai into Palestine in the present campaign. He passed through Rafa, Khan Yunus, and Gaza, and, by way of Esdud and Ramleh, arrived at Jaffa on March 5th. On March 15th he left for Acre, Larrey having accompanied him the whole way

from El-Arish. There is no room in this short article to give any account of the siege of Acre, which ended so disastrously for Napoleon's Syrian Campaign, of the harassing warfare to which he was subjected by the Arabs, or of the outbreak of plague which so seriously affected his troops. It is only interesting to note that Larrey relates that all the wounded were evacuated, during that period, as they are to-day, to Egypt, and that by the time the Army eventually evacuated Syria, 800 had been sent across the desert of Sinai by camel convoy, and 1200 had been sent by sea, the majority being embarked at Jaffa. On the 21st and 22nd May Napoleon's Army finally left Syria for Egypt, passing on its way through Cæsarea, Jaffa, Gaza, El-Arish, Katia, Salhien, and Bilbeis. Napoleon returned to Cairo, and then, on hearing the news that an army of 20,000 Turks had descended on Aboukir, left for Alexandria. The land battle of Aboukir was fought, and subsequently, on August 22nd, Napoleon, on the pretext of making an inspection of the northern coast of Egypt, embarked on a ship and left surreptitiously for France. Larrey remained in Egypt with Kleber, and he relates that in the month of June, 1801, the troops outside Alexandria were once more severely attacked by ophthalmia. As he says:

"The occurrence of a north-north-west wind, and the overflow of Lake Ma'dyeh, whose waters inundated our camp, caused a pronounced outbreak of ophthalmia, and more than 3000 individuals passed successively through the hospital. This outbreak was treated promptly and with great success, but was followed by an outbreak of scurvy."

He notes that this particular outbreak of ophthalmia was followed in many cases by the formation of pterygia.

In August, 1801, the English and Turks attacked Alexandria, and on August 31st Alexandria capitulated, and an armistice was signed. Larrey took this opportunity of visiting the English camp, and obtained from Dr. McGrigor an interesting report as to the losses of

the European and Indian troops during their stay at Rosetta and Alexandria. It appears that of 7886 men who composed the English Expeditionary Force, 158 had been sent home to England either blind or crippled. On October 17th Larrey left Egypt with the Army for France, and Napoleon's Egyptian Campaign was over.

Throughout his description of the expedition, Larrey emphasises the fact that ophthalmia was one of the most serious affections to which the Army was subject, and in his subsequent memoir he discusses the symptoms in great detail. To quote his actual words:

"The eyes, having been struck suddenly by the blazing light of the sun, either direct or reflected from the glaring white soil of Egypt, have immediately felt the effects of the stoppage of the cutaneous perspiration during the cold nights, and the result has been an obstinate ophthalmia, and, with a fair number of persons, complete blindness. I will enumerate the symptoms which arose. Swelling of the lids and of the conjunctiva, and sometimes of the coats of the eye; extreme local pain, attributed by the patient to the presence of grains of sand (these are dilated vessels); diminution of vision and inability to stand a bright light. To these first symptoms soon succeeded violent headaches, giddiness, and insomnia. The few tears which are secreted are bitter and irritate the lids and puncta lacrymalia. All these symptoms are aggravated and are frequently followed by fever. The disease reaches its crisis on the third or fourth day, sooner with some individuals, later with others. The termination varies. When it is inflammatory and is left solely to the resources of Nature, there form, ordinarily towards the sixth or seventh day, points of suppuration on the edges of the lids, on the external surface, and at the angles. The ulcers spread by degrees on to the conjunctiva, attack the cornea and often perforate it. Sometimes the cornea gives way suddenly, without ulceration; I have seen several such cases. The rupture occurred within the first twenty-four hours, when the conjunctiva was hardly red,

and it is difficult to understand the cause of this rapid and spontaneous rupture. We content ourselves with observing the phenomena which have occurred in Egypt, and the effects which have been produced. The opening which resulted is round and of a diameter almost the same in all the patients who have been attacked. It allows the passage of a portion of Descemet's membrane or of the iris, and forms a hernia, known by the name of 'Staphyloma.' The swelling formed by Descemet's membrane is a dull grey (*gris terne*), that of the iris of a darker colour. This swelling is painful to the lightest touch of outside objects, and to the rubbing of the lids. The vision during the early days is more or less diminished, according as the pupil is partly or entirely obscured; but generally the staphyloma shrinks by degrees, goes back into the anterior chamber, and the membranes resume their previous positions. Sometimes there remains a small portion outside, which is strangled by the closing of the aperture, loses its sensitiveness, and acquires a certain toughness, or else it swells and divides into several globules and takes on a carcinomatous character, especially if there is any complication of venereal disease."

Larrey proceeds to recount that the perforation was often followed by the loss of the lens and the vitreous, and that the eye subsequently shrinks.

Hypopyon was rarely present. Leucomata were frequent, often complete, and followed by total blindness. The tarsal cartilages were rarely affected. In general, the ophthalmia weakened the sight and predisposed to cataract, lacrymal fistula, and glaucoma, and was often followed by night-blindness and "gutta serena." (In the cases of night-blindness and glaucoma, they employed with success a moxa on the principal branches of the lesser sympathetic nerve (*nerf fascial.*))

Larrey attributes the ophthalmia to the burning heat of the day, the reflection of the rays of the sun from the earth, immoderate consumption of alcohol and venereal excess, the dust in the air, and the checking of the

cutaneous perspiration by the cold night air. He notes that blonde men were more frequently attacked than brunettes, and that the right eye was affected more than the left. Nearly all who lost the sight of one eye lost the sight of the right. He attributes this in part to the fact that as most people sleep on the right side that part is most affected by the humidity of the earth.

Ophthalmia was also most prevalent during the overflow of the Nile. It was also remarked that suppression of gonorrhœa frequently produced ophthalmia, and that the best way to establish a cure was to re-establish the urethral discharge. The treatment advocated included bleeding, leeches on the temples, hot foot-baths, a lotion of a strong decoction of linseed, poppy-heads, and saffron, also compresses of tow soaked in white of egg and rose-water and some grains of sulphate of alum and camphor, applied every evening. In the later stages, lotions of acetate of lead, mercuric chloride, sulphate of copper, or sulphate of zinc were used.

Ulcers of the lids were treated with an ointment, for which he gives the following prescription :

Cerate of wax and almond oil . .	℥j
Red oxide of mercury . . .	gr. iv
Oxide of zinc	„ xvi
Camphor dissolved in the yolk of an egg	„ iv
Cochineal paste	„ viii
Oriental saffron	„ vi

Larrey says that ophthalmia hardly spared anyone in 1798, and nearly all cases were inflammatory. In 1800 a few soldiers were affected and the cases were less severe and more easily treated. The severe outbreak which occurred again in 1801 near Alexandria has already been mentioned. It was noted that the malady presented various characteristics, but in general it was inflammatory, but with symptoms less intense than those of the outbreak of 1798.

The English, on their arrival in Egypt, were not exempt

from the disease. After some time they followed the French practice as laid down by Larrey, which they found in a memorandum left at Rosetta, and from that moment they saved the sight of the greater number of their patients.

Larrey also notes that many French soldiers who escaped ophthalmia were struck almost immediately on returning to France with a more or less complete blindness, which "appeared to be due to paralysis of the visual organ, consequent on the sudden passage from the tropical climate of Egypt to that of France in the winter season."

This short account embodies all that Larrey has to say with reference to military ophthalmia in the Egyptian Expedition of 1798–1801, and it appears obvious, from his very vivid description, that the disease, at any rate as he saw it, was not trachoma at all, but an outbreak of an acute and infectious ophthalmia, similar to that which is too common in Egypt to-day, and due in nearly all cases to the Koch Weeks' bacillus. A visit to the ophthalmic department of any Egyptian hospital will show numberless cases exactly corresponding to those described by Larrey.

Acute purulent conjunctivitis is extremely common among the natives of Egypt, and it is followed, in a very large proportion of cases, by perforation of the cornea, leucoma adherens, and subsequent glaucoma. In addition, there are still seen occasional cases of that terrible acute Egyptian ophthalmia described by Larrey, in which the cornea appears rapidly to melt away, and panophthalmitis occurs within twenty-four to thirty-six hours.

Throughout the whole story there is no mention of any disease resembling trachoma, and though it is extremely likely that a certain proportion of French soldiers in Egypt did contract trachoma, and may have taken it back with them to Europe, it is evident that the military ophthalmia, which made such a great impression upon the physicians at that time, and upon military historians, was an acute infectious ophthalmia of a virulent type.

It is unfortunate that Larrey gives no actual statistics as to the number of soldiers attacked and the proportion to the total number of troops employed, but apparently nearly all the 30,000 troops were affected. In fact, ophthalmia and plague were the two diseases which caused the heaviest loss to the expedition.

In the present campaign the Egypt Expeditionary Force has fought its way along much the same path as that followed by Napoleon's troops. Though one can hardly any longer describe the fertile delta of Egypt and the country from Alexandria to Cairo as "the arid deserts which border Lybia," the Sinai peninsula is as desolate as it always has been, and the sand and the glare, the daily heat, and the nightly cold of the desert remain unchanged. Nevertheless, there has been no outbreak of ophthalmia in any way comparable to the epidemic of 1798–1801. In fact, there has been no outbreak of any size at all, and, to the great surprise of most people, the experience of the British Army has been that not only is trachoma less infectious than it has hitherto been supposed, but also that with the ordinary personal cleanliness of the modern British soldier, and with modern treatment, ophthalmia has lost its terrors for armies operating in Egypt.

Military exigencies will not permit of the disclosure, at the present time, of the number of the troops which are in the Egypt Epeditionary Force, and exhaustive statistics as to all the ophthalmic cases which have been treated during the last three years are not available, owing to a great extent to the changes in *personnel* and the movements of field medical units; but the following statistics, compiled from the records of base and stationary hospitals for the year 1917, will give some indication as to the incidence of ophthalmia and the nature of the infection.

Particulars are available of 11,873 ophthalmic cases seen during 1917. Of these, 6088, or roughly 50 per cent., were errors of refraction. Of the remaining 5785 cases, 1116, or 19·2 per cent., were acute infections of the conjunctiva. Clinically, 288 were of the angular

type and 716 were either simple, muco-purulent, or unspecified conjunctivitis of varying severity. There were 9 cases of purulent conjunctivitis in which gonococci were not found, and 5 cases of gonorrhœal ophthalmia (4 Australian and 1 British). In 79 cases which were bacteriologically examined, 54 showed the Morax Axenfield, and 25 the Koch Weeks' bacillus. The cases of conjunctivitis have been observed uniformly at all the hospitals, and nowhere has there been anything approaching a local outbreak or general epidemic. Only 1 case of perforation of the cornea with the formation of a staphyloma has been recorded.

Of trachoma, 64 cases of old-standing disease and 39 of recent trachoma have been seen. Of the 39 cases of recent trachoma 26 were soldiers from Australia, where trachoma is prevalent, and of these 26, Major Mitchell, of the Australian Medical Service, who was in charge of the ophthalmic department at No. 14 Australian General Hospital, reports that only 2 were possibly acquired in Egypt. When it is remembered that trachoma is almost universal among the inhabitants of Egypt (over 90 per cent. being infected), that the Egyptian Labour Corps, almost all more or less infected, have been working alongside the Australian and British troops for weeks and months, and that Egyptian orderlies have been serving in large numbers in British hospitals, it is evident that trachoma is really not a danger to modern troops, with modern habits of cleanliness and sanitation. Surgeon-General Sir William Babtie told me on one occasion that he described the disappearance of trachoma in the British Army to the abolition of the roller towel, a fertile source of infection in years gone by, in schools, orphanages, and workhouses.

The attacks of conjunctivitis have exhibited no unusual symptoms. They have varied in severity from the simple conjunctivitis with some hyperæmia of the conjunctiva to the acute muco-purulent conjunctivitis, with sub-conjunctival ecchymosis and fairly profuse discharge. They have

all reacted to treatment quickly and well, and, as has been mentioned before, there have been practically no serious sequelæ.

No special precautions have been taken to prevent any outbreak of ordinary ophthalmia, reliance having been placed on the ordinary sanitary arrangements in camps and barracks, and the extremely low incidence of ophthalmia among the troops has amply shown that no special means of prevention was necessary. Treatment has been carried out on the old lines. Zinc sulphate in solution of from $\frac{1}{2}$ to 1 per cent. is the antiseptic which is recognised as the most generally useful and efficacious by the military ophthalmic surgeons as well as by the civilian oculists in Egypt. Perchloride of mercury, silver nitrate, argyrol, and protargol have all been used, but there is no evidence to show that one drug has any marked superiority over any other.

With reference to trachoma it was early recognised that an epidemic, if it did occur, might have serious consequences for the Army, and shortly after my arrival in Egypt in the autumn of 1915, the following regulations, with reference to the treatment of trachoma, were issued as a measure of precaution:

(1) Trachoma is an acute infectious disease, and must invariably be treated as such.

(2) All cases must be isolated in a separate room or tent, or on board ship in a separate cabin or ward. Infectious patients must not associate with their comrades, even during recreation or exercise.

(3) Special attendants must be detailed to look after cases of trachoma, and must be warned to pay particular attention to personal cleanliness, always washing their hands after dressing a case. For this purpose a basin of disinfectant must always be kept in the ward.

(4) The instructions given to attendants on cases of typhoid or other infectious complaint are generally applicable in the case of trachoma.

(5) Separate specially marked feeding utensils must be supplied.

(6) A separate latrine and urinal must be set apart for trachoma cases. If these are few in number, a night-stool for their use will suffice.

(7) All dressings used must be placed in disinfectant and burnt at the earliest opportunity. If eye-shades are used, they must be burnt when discarded.

(8) Dark glasses must be sterilised by boiling.

(9) Pieces of linen and cotton rag should be issued instead of handkerchiefs, and, when discarded, treated in the same way as dressings.

(10) Hospital clothing and bedding must be disinfected before being sent to the wash.

(11) Officers commanding hospital ships carrying cases of trachoma must notify the same to the disembarking medical officer.

The Army Council has also published an instruction (April 4th, 1917) that—

(i) In future, all soldiers suffering from undoubted trachoma will be discharged from the Service as soon as the disease is diagnosed.

(ii) When a man suffering from trachoma is about to be discharged from the Service, a notification of the fact will be sent to the civil medical officer of health of the district in which the man intends to reside.

Happily, as shown by the statistics quoted above, trachoma has been practically non-existent as a disease among the British troops in Egypt and Palestine, and it is certain that there is no danger either of the Army becoming infected in Egypt or of discharged soldiers infected with trachoma spreading the disease in England on their return home.

Ophthalmia in the Turkish Army.—In Palestine before the war, trachoma, next to malaria, was one of the most prevalent diseases, and it is evident from the incidence of ophthalmia among Turkish prisoners that it is very preva-

lent among the Turkish troops. Figures from one of the Turkish prisoners of war camps in Egypt show that from July, 1917, to January, 1918, there were 1163 cases of ophthalmia, the average monthly population of the camp being a little over 8000.

Of these 1163 cases 290 were simple trachoma, 427 trachoma associated with acute conjunctivitis, and 446 were muco-purulent or purulent conjunctivitis.

These figures do not mean that there have been any epidemics of ophthalmia in the camps themselves. With every fresh batch of prisoners there arrive a large number of soldiers affected with ophthalmia in all degrees of severity; after a week or two's treatment the ophthalmia is cured, and the incidence of ophthalmia drops until the arrival of a fresh batch of infected prisoners. It will be seen that in seven months there were as many cases of ophthalmia among 8000 Turkish prisoners as there were in the whole Egypt Expeditionary Force in a year.

The incidence of ophthalmia among the Turkish troops in Palestine must therefore be far higher than among the British troops, though, as has been mentioned before, military exigencies do not permit of any comparison of percentages at the present time.

The results of the ophthalmia are also much more serious among the Turkish and Arab prisoners. Of 78 Turkish prisoners suffering from eye disease left behind in Jerusalem in the recent advance and now in a prisoners of war hospital in Egypt, there were 29 cases of corneal ulcer. Of these, 15 had perforated the cornea and 14 had not. In addition, 30 cases were blind in one or both eyes. Of these, 13 were blind in one eye as the result of perforating corneal ulcers and 2 were blind in both. Two were blind in both eyes as the result of ophthalmia and 2 were blind in one eye. Three more had lost the sight of one eye as the result of injury, and 2 had lost the sight of both eyes.

The deductions that may be drawn from the above facts are as follows:

(1) That whatever may have been the cause of the spread of trachoma in Europe as the result of the Napoleonic campaign in Egypt in 1798–1801, the epidemic of ophthalmia which so disastrously affected the Army in Egypt was not trachoma, but an acute, purulent ophthalmia with corneal ulceration, similar to the acute, infectious ophthalmia so prevalent in Egypt among the native population of to-day.

(2) That with modern habits of personal cleanliness and camp sanitation, trachoma is not actively infectious among large bodies of men, and that no special measures of prevention are required in a modern army operating in Egypt or Palestine.

(3) That the incidence of ophthalmia, acute and trachomatous, with corneal ulceration, is probably nearly as high now among the natives of Egypt as it was in the time of Napoleon, though the efforts of the travelling ophthalmic hospitals of the Department of Public Health are slowly lessening its ravages, and that the prevalence of ophthalmia among the Turkish prisoners of war shows that it may still cause serious epidemics in the absence of modern standards of personal cleanliness and of camp sanitation.

In conclusion, I should like to thank Dr. H. V. Keatinge, C.M.G., Director of the School of Medicine, Cairo, for access to the Kasr-el-Aini Hospital Library and to Larrey's works, and to Dr. E. C. Fischer, Professor of Ophthalmology, Cairo School of Medicine, for much valuable information with reference to ophthalmia in Egypt.

The natural history of trachoma.

By E. Treacher Collins.

As I have been the visiting Ophthalmic Surgeon to the Metropolitan Asylums Board Ophthalmia Schools since they were first opened, it may be interesting to you if I tell you briefly how the work has been carried on in them. This Ophthalmia School, here at Swanley, was opened in 1903, and a similar one at Brentwood in 1904. My instruction was to admit to the schools children suffering from contagious eye diseases. I have, for this special purpose, given to the term "contagious eye diseases" the widest possible interpretation. I have taken it to apply to any child who has any abnormal discharge from the eye which might be conveyed to another child's eyes by a towel, or other such washing appliances. By such an interpretation I think all children who it is conceivable might be in the least dangerous as a source of infection to other healthy children are regarded as suitable for admission. In some, doubtless, the danger is very slight, for under this definition cases of lacrymal obstruction and marginal blepharitis are included.

The total number of children admitted to the two schools since they were first opened in 1903, up to the end of 1917, is 7163, of which 1687 were diagnosed as suffering from trachoma, and 5476 from other contagious eye affections.

The first thing I am called upon to do, after having decided that a case is a suitable one for admission, is to say whether it is or is not suffering from trachoma. The trachoma cases in the school are to some extent kept separate from the non-trachomatous cases. They are lodged in separate cottages, wash in separate lavatories, and are treated in separate rooms by separate nurses. They are allowed, however, to mix together with the non-

trachoma cases in the schoolrooms and in the playgrounds.

Trachoma is now generally admitted to be a contagious eye disease. As to its contagious character I have previously published very convincing evidence gathered from experience at these schools.* Up to the present we have no certain knowledge as to the exact nature of the contagious factor, though it seems probable that it is an ultramicroscopic organism. Infection of trachoma, like that of other forms of ophthalmia, seems not to be transmitted through the air, but only by transference of moist discharge from one person's eye to another. It is acting on this theory that the arrangements for the children in this school have been planned, and the experience gained from them seems to show that it is correct. During my fifteen years' experience of the working of the schools I have seen only a very few cases in which I can definitely say that a child admitted for an affection of the eyes which was not trachomatous has during its sojourn here contracted trachoma. Did air-borne infection really occur, such cases would have been of common occurrence, and I myself, or Mr. Tyrrell, who has been in almost daily attendance at the schools since they were opened, or the attendants and the nurses who look after the children, would surely have become affected. It is true that two nurses and one attendant have contracted trachoma whilst in the school, but the possibility of infection in them by the direct transference of discharge cannot be excluded; indeed, it seems most probable that such transference did occur.

In the absence of any certain knowledge as to the specific organism of trachoma the diagnosis of the disease in its early stages must necessarily be attended with much difficulty. I propose, however, to put before you an hypothesis with regard to the nature of trachoma which seems to me to explain so many of the difficulties in connection with it, and to be so useful as a guide to the line

* *Vide Roy. Lond. Ophth. Hosp. Rep.*, vol. xviii, p. 3.

of treatment to be employed, that I think it must be, if not quite true, approximately so.

I would define trachoma as *a chronic contagious disease which is confined to the conjunctiva and which is characterised by a new formation in it of lymphoid tissue.*

Of its contagious character I have already spoken; when it exists by itself, experience at these schools has shown me that it is always a chronic affection. Acute exacerbations of symptoms, when they occur, I have found to be due to the presence of some well-known organism to which they can be attributed. Cases which commence with acute symptoms, viz. much discharge, redness, and papillary hypertrophy, are due to mixed infection, the acute symptoms being generally attributable to the presence of either Weeks' bacillus or gonococci. The presence of an acute affection, as I will point out directly, facilitates the implantation of the trachomatous disease.

The chief characteristic of trachoma is the presence of what is called lymphoid tissue in the sub-epithelial layer of the conjunctiva. It is not, however, the only disease of that membrane in which nodules of lymphoid tissue are met with. In acute muco-purulent ophthalmia, nodules of lymphoid tissue are frequently found in the retro-tarsal folds, after the more acute symptoms have subsided, so-called "follicular conjunctivitis." In children who are the subject of adenoids and granular pharyngitis nodules of lymphoid tissue are also often met with in the retro-tarsal folds of the conjunctiva. What, then, is the essential difference between the lymphoid tissues of these affections and that met with in trachoma? The hypothesis I put before you is, that in follicular conjunctivitis only an enlargement of the normal lymphoid follicles takes place due to the presence of some chemical irritant. Whilst in trachoma there is an invasion of the sub-epithelial tissue itself by micro-organisms, which, having penetrated the outer defence of the epithelium then become surrounded by a new formation of lymphoid tissue.

With this hypothesis before us we can understand why it is that in follicular conjunctivitis the lymphoid follicles are confined to the retro-tarsal folds, where normally the lymphoid tissue exists; why the follicles always remain discrete, being only capable of a certain amount of enlargement; also, how it is that they become absorbed without undergoing any degeneration. The trachoma follicles being due to a new formation of lymphoid tissue around micro-organisms, may arise in any part of the membrane, and if the micro-organisms are situated near together they may become confluent and reach a considerable size, so that they present the characteristic appearance which is compared to "frogs' spawn" or "boiled sago." The tendency which trachoma follicles have to work their way to the surface, break down, and evacuate their contents is, I take it, evidence of the natural tendency of the tissue to rid itself of the infecting organisms.

Softening of the epithelium such as occurs in an acute inflammation of the conjunctiva, would favour its penetration by micro-organisms into the sub-epithelial tissue; hence the infection of the conjunctiva with pus-producing organisms would be a factor which would favour the onset of trachoma.

Trachoma is not a disease which is met with elsewhere than in the conjunctiva. This is probably due to peculiarities in the anatomical structure of that membrane, viz. the thinness in places of its covering epithelium and the presence immediately beneath the epithelium, not of dense fibrous tissue like the corium, but of delicate loose areolar tissue.

Trachoma affects the surface of the cornea, but anatomically it is correct to regard the epithelium covering that structure as a part of the conjunctiva, with which it is directly continuous. In the condition we term "trachomatous pannus" there is a new formation of lymphoid tissue and blood-vessels beneath the epithelium of the cornea, between it and Bowman's membrane. This pannus

occurs in the later stages of the disease, when the corneal epithelium has become softened by continuous chronic discharge, and where it has had infected material rubbed in by the movement over it of the affected tarsal conjunctiva.

It has been suggested that trachoma sometimes involves the lacrymal sac ; it is difficult in the present state of our knowledge to state definitely whether it does or does not. In opposition to such a view I may mention that amongst the numerous children in these schools who have had trachoma, comparatively very few have suffered from any disease in the lacrymal passages, certainly not more than might have been met with amongst an equal number of children suffering from non-trachomatous forms of conjunctivitis.

It is the presence of the loose areolar sub-epithelial tissue in the conjunctiva which allows of the development of trachoma ; in a long continuance of the disease it may ultimately be brought to a termination by an upgrowth of fibrous tissue which replaces the areolar tissue. This is what is spoken of as the " cicatricial stage " of trachoma. The conjunctiva comes then to approximate closely the skin in its histological appearance, having a dense fibrous corium immediately beneath the epithelium. When the whole of the conjunctiva has become affected by this change the trachomatous disease is necessarily arrested. Such changes in the conjunctiva are often terribly destructive to the eyeball as a visual organ ; either by obliteration of the orifices of the glands opening into the conjunctiva sac, resulting in xerosis, or by distortion of the eyelids and the production of entropion.

The hypothesis I put before you not only assists us in understanding the natural history of trachoma, but also furnishes rational grounds for the application of treatments which for the most part have been adopted empirically.

The tendency which trachoma follicles have to make their way to the surface, degenerate, and expel their contents, can be hastened by the operation of expression.

If, as I suggest, the lymphoid tissue is to be regarded as a new development encircling these specific organisms, then by squeezing out the lymphoid follicles whenever they form, we are assisting the natural processes in eliminating the essential cause of the disease. However skilfully the operation of expression is performed, some trachoma follicles are liable to be left. Either they are situated too deep, or the membrane overlying them is too adherent to the subjacent tissue, to allow of their being expressed. The conjunctiva overlying the tarsus is attached firmly to it, and it is in this region, especially, in which the follicles fail to come away.

However chronic a case of trachoma may be, there is always a certain amount of phagocytosis excited. Polynuclear leucocytes are found in the secretion and also in the tissue of the conjunctiva surrounding the follicles. Experience has shown that when this phagocytosis is increased in amount, a salutary effect on the trachomatous disease often results, *i. e.* an acute exacerbation of symptoms helps to clear up chronic cases. It was with this end in view that our forefathers adopted the heroic procedure of inoculating chronic trachomatous eyes with gonorrhœal matter. A similar effect can be produced in more controllable and satisfactory ways. The time-honoured use of copper sulphate for trachoma finds a rational explanation in the special and peculiar property which copper has in exciting phagocytic exudation. One of the cleanest, rapid, and least painful methods of producing absorption of trachoma follicles by phagocytic action is by the application of carbon dioxide snow. Mr. Tyrrell, who has had considerable experience of this method of treatment, will give you a demonstration of how it is being employed in these schools.

I have already mentioned that one way in which trachoma comes to a natural termination in advanced cases is by a new formation of fibrous tissue replacing the sub-epithelial areolar tissue. Some of the very vigorous forms of treatment which have been employed,

such as grattage, act, I would suggest, by hastening the formation of such fibrous tissue, and so destroying the tissue in which the lymphoid follicles develop.

In conclusion, I should like to mention that the experience gained at these schools has afforded me exceptional opportunities of observing and watching cases of trachoma in all stages of its development and progress. I have had many cases to deal with in an exceedingly early stage, where the abnormally situated lymphoid follicles are only present, and where there is no new formation of fibrous tissue. Such cases, if treated regularly and systematically for a long time, as they have been in these schools, can be cured without the formation of fibrous tissue. In the examination of such cases after they are cured, so little change is left in the affected membrane, that it would be impossible for even a skilled observer to diagnose that the patient had ever suffered from trachoma.

Col. W. T. Lister,

in personal comment, said he would like to bear testimony to the splendid work which Major Cunningham had done for the trachoma problem in France. That officer had had exceptional experience of the disease in England, and his help and guidance had been invaluable. With regard to the success of the scheme of which the paper gave particulars, it was in great measure due to the work of those at headquarters, who had to classify the men as they arrived, sometimes in batches of 5000. If they had not been classified properly to begin with, the whole scheme would have been wrecked. He would also like to give special praise to the ophthalmic specialists in charge of the trachoma treatment centres, who, month in and month out, were devoting themselves to keeping the coolies' eyes as healthy as possible ; laborious work which, if it were not for the results, would be very uninteresting. This work was not less trying by reason of the fact that the tracho-

matous men had to be treated between their hours of work—so that this might not be interfered with. In two large centres, the average percentage off duty daily on account of eye trouble was ·028 in the "X" companies, ·066 in the "Y" companies, and only ·033 in the "Z" companies. Capt. Matthews reported ·09 per cent. in his "Z" companies. It would thus be seen that the amount of labour lost on account of trachoma was extraordinarily small.

Capt. M. L. Hine:

Amongst 4500 Chinese in the area there are three trachoma companies (about 1500) and two chronic conjunctivitis or "doubtful" companies. Some of the companies have been inspected four times since last August, and one has found several cases in the "Y" companies (chronic conjunctivitis), which have had to be transferred to "Z" (or trachoma) companies, after having been passed at earlier inspections as non-trachomatous, so there has been the opportunity of seeing the infection at its very earliest stage, such as we occasionally had at Swanley. I see that Kirk, in his paper in the March *British Journal of Ophthalmology*, thinks that in most cases the initial infection dates from early childhood, but certainly here one can see numbers of recently infected cases.

A very large proportion of the cases are uncomplicated, with very little papillary hypertrophy, and merely small pin-head follicles scattered about the tarsus. The men suffer very slight inconvenience from the affection when they have regular treatment, and improve rapidly with treatment in spite of the fact that this is necessarily somewhat scanty owing to the large numbers dealt with. The value of expression in those cases with many follicles has been very marked.

Very few complications are seen, largely due to the fact that the worst cases with trichiasis, entropion or corneal ulceration have probably been excluded in China.

Out of 100 definite trachoma cases I examined with a loupe to see how much pannus was present, I found one case of trichiasis, and as regards pannus I found as under :

One very severe (with corneal ulceration) ; 6 severe (extending over pupillary area and affecting vision) ; 16 slight (not extending over pupillary area) ; 18 very slight (only discoverable with a loupe, with vessels just creeping on to cornea). Total, 41.

Of the remaining 59 cases with no pannus, several were old scarred cases, and several others had marked follicles with papillary hypertrophy.

Mr. A. F. MacCallan :

On the mobilisation of the Egyptian travelling hospitals a hospital* of 650 beds was placed under the command of the Director of Ophthalmic Hospitals for the treatment of the sick and wounded coming to Egypt from Gallipoli and later from Salonica. Also five of the thirteen permanent ophthalmic hospitals were used for military patients. These were used as general hospitals, as the eye cases were few. At the other ophthalmic hospitals a few military eye cases have been treated from time to time. The total number of eye cases treated was only 1063, of which 27 were trachoma and 315 were other varieties of conjunctivitis. Of the cases of trachoma, 21 were apparently long-standing cases which certainly had not become infected in Egyyt, while 6 of the cases exhibited the earliest stage of the disease (MacCallan's stage 1). Whether these cases were infected in Egypt it is impossible to be certain about, but probably they were.

The diagnosis of trachoma was made by the Egyptian medical officers, who are especially experienced in the recognition of the disease. All patients who have not

* Owing to the sufficiency of beds in the Army hospitals, demobilisation of this unit was ordered by the General Officer Commanding Lines of Communication in March, 1916, with the reluctant assent of the Director of Medical Services.

obviously got trachoma have their clinical notes written on a differently coloured sheet from trachoma cases, and these are stamped "infected with trachoma" when more detailed examination reveals the disease.

Whether or not all these cases of trachoma came to the notice of the medical authorities, it is impossible to say; many of them came for out-patient treatment at distant places like Assiut or Minia, and no official returns were asked for by the Army medical authorities or made about

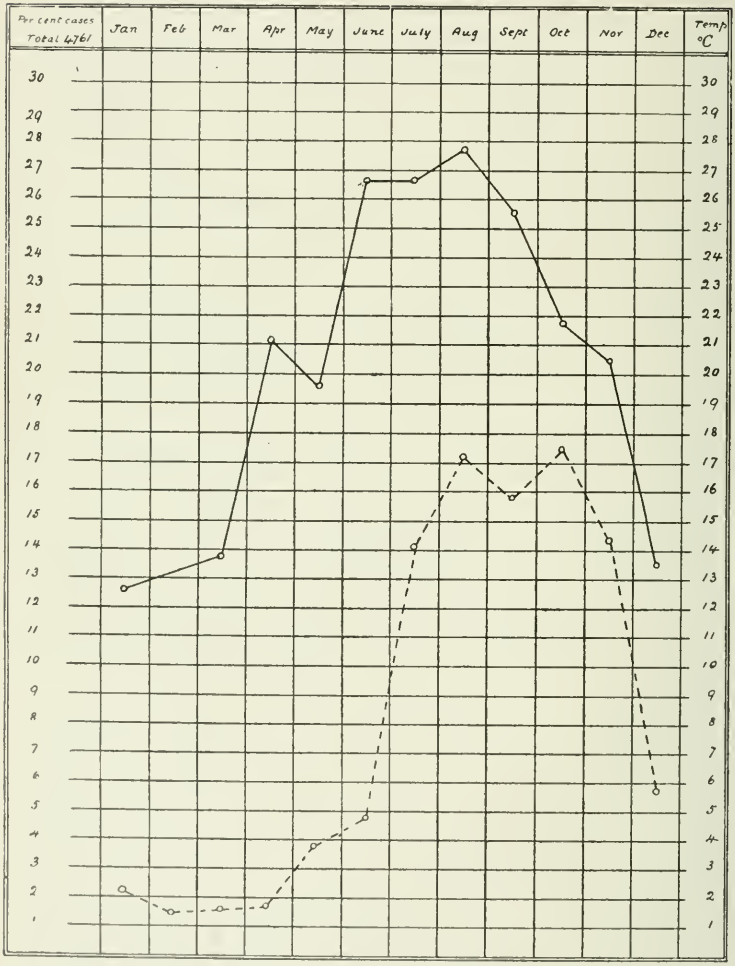
TABLE I.—*Organisms found during* 1917.

Organisms.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Gonococcus .	110	65	68	76	187	233	670	817	760	825	677	273	4761
Koch-Weeks .	102	110	144	241	361	216	304	293	305	273	203	147	2699
Morax-Axenfeld, or diplo-bacillus	74	107	115	118	307	233	206	327	315	306	208	181	2497
Pneumococcus	15	15	31	31	68	48	38	57	57	44	48	27	479
Xerosis . .	2	4	20	12	21	9	14	16	14	26	7	10	155
Staphylococcus	3	1	1	—	2	10	10	28	32	5	3	3	98
Micrococci .	—	—	—	—	2	3	—	—	—	—	—	—	5
Streptococcus	3	1	1	—	2	2	—	—	—	2	2	—	13
Other organisms	21	24	20	28	17	10	4	11	7	7	5	4	158
Negative .	49	58	84	94	167	163	218	175	185	260	228	96	1777
Total .	379	385	484	600	1134	927	1464	1724	1675	1748	1381	741	12642

them by the Egyptian medical officers. My attention was not drawn to the matter until statistics were being made. At the present time all military eye cases are sent to Army base hospitals for treatment, to ensure, I presume, the adoption of precautions against the spread of the disease among the troops.

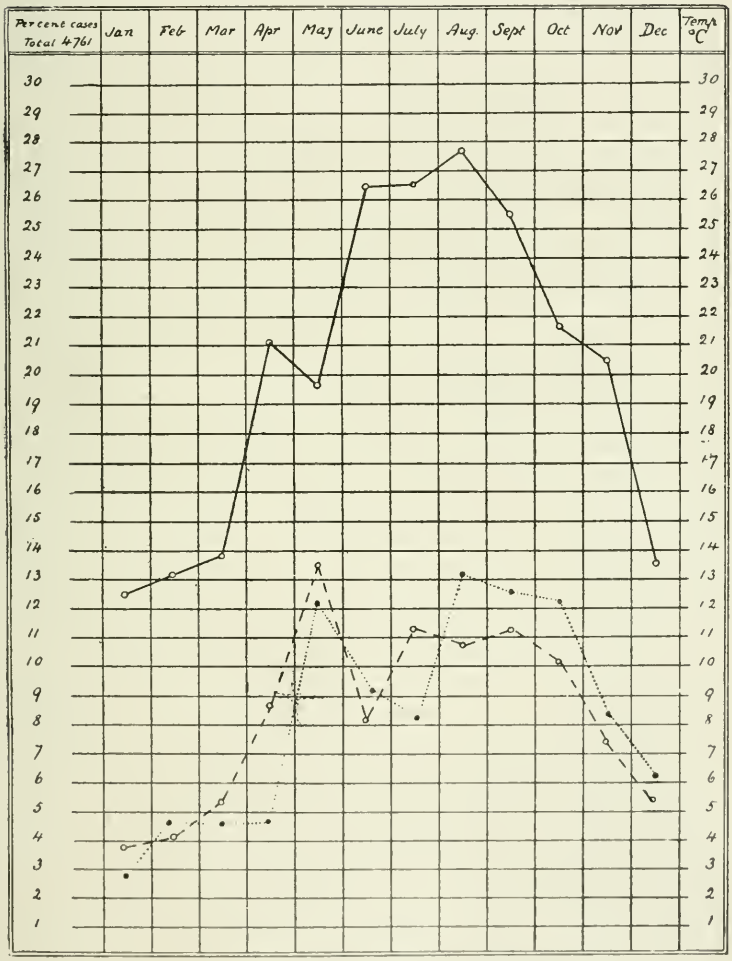
Few of the 315 cases of conjunctivitis were examined bacteriologically for the detection of the causative organism, as is invariably done during the ordinary routine of the ophthalmic hospitals. The gonococcus was found in 37 per cent. of 12,642 examinations in 1917, the Koch-Weeks bacillus in 21 per cent., and the Morax-Axenfeld

TABLE II.—*Curves showing Variations of Temperature and Gonococcal Conjunctivitis.*



——— Temperature in degrees Centigrade, 1917.
- - - - - - - Per cent. of cases in each month of total 4761, 1917.

TABLE III.—*Curves showing Variations in Temperature and Conjunctivitis due to Koch-Weeks and Morax-Axenfeld Bacillus.*

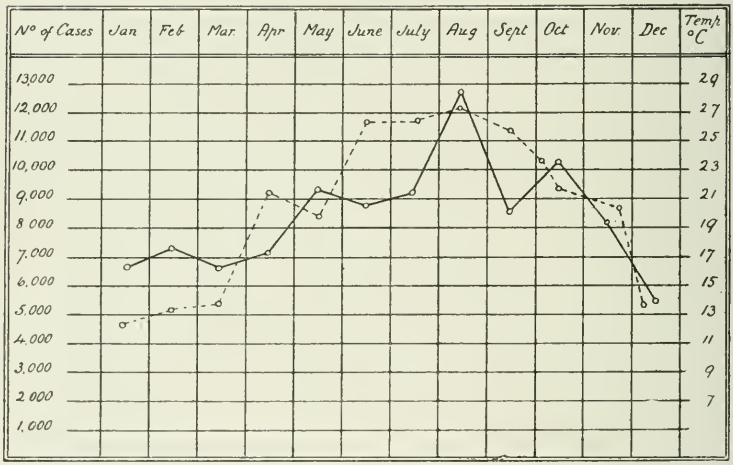


——— Temperature in degrees Centigrade, 1917.
- - - - - - - Koch-Weeks, total cases 2699, 1917.
... . Morax-Axenfeld, total cases 2497, 1917.

in 19 per cent. (see Table I). It should be noted that the gonococcus has not a venereal origin, but spreads from eye to eye among the fellahin.

From an examination of the curve (Table II) of the seasonal incidence of the gonococcus it is seen that while comparatively rarely met with in January, February,

TABLE IV.—*Curves showing the Patients Examined per Mouth at the Ophthalmic Hospitals during* 1917.



——— Patients examined per month, 1917.
- - - - - - - Temperature in degrees Centigrade, 1917.

March, and April, its activity becomes awakened in May and increases rapidly in July, reaching a maximum in August. In September there is a slight fall in the number of cases, but they increase again in October. In November a very rapid diminution occurs, persisting through December.

A curve of the temperature variations, if compared with the previously mentioned curve of the monthly incidence of gonococcal conjunctivitis shows that rises and falls in the temperature curve precede by one month or two months rises and falls in the curve of gonococcal

activity. A similar relation between the temperature and gonococcal activity was charted in my reports for 1914, 1915, and 1916.

A comparison of the temperature curve (Table III) and curves for the bacillus of Koch-Weeks and for the diplobacillus of Morax-Axenfeld does not exhibit close relations, although the beginning heat of summer precedes the annual increase in activity of both organisms, and the fall of the average temperature in the autumn antedates the same seasonal diminution of the conjunctivitis caused by them.

In this connection Table IV should be consulted showing the monthly variations in the number of patients examined, which also bears a close relation to the temperature.

Mr. F. A. C. Tyrrell

said he had occupied the post of assistant medical officer of the ophthalmia schools for fifteen years, and during that time, as Mr. Collins had just stated, about 7000 cases had passed through their hands. Therefore, he was able to speak with some authority when he said that of all the numerous weapons with which trachoma had been attacked in the case of their patients there, carbon dioxide snow had been one of the most successful. It was most useful in removing the follicles which were situated over the tarsal conjunctiva. When follicles appeared on the centre of the retro-tarsal fold, or on the semilunar fold, it was easy to get rid of them by expressing the follicles, or by excising the fold when the condition there was very bad. But when follicles appeared in the extreme corners, it was a more difficult matter, and many inventions had been devised with the object of obtaining access to these regions. The implement used here for those cases was shaped like a double button-hook. When the schools were first opened, the X rays and radium were employed, and where there were many follicles in a patient, scraping was done with different sizes of

rasps, after tearing open the follicles and rubbing in a solution consisting of 1 in 100 perchloride of mercury. The chief disadvantage of that method was that it led to much scarring. The X-ray treatment was satisfactory, so far as it went, but it was difficult to undertake the treatment of these cases in that way without the risk of the fingers of the operator being injured by such constant exposure to the rays, for the eyelids of the patient had to be kept everted by the fingers during the treatment, and Mr. Mayou and he had suffered in this way from bad X-ray burns of the fingers. Mr. Collins then invented an instrument which everted the lid without so much exposure of the fingers. Still, even then, they found a practical disadvantage connected with the use of the rays in these cases, in that there was no means of regulating the amount of reaction; some cases reacted much more readily to the influence of the X rays than did others. With regard to individual follicles, where there were only one or two scattered over the tarsus, these could be removed by digging out the follicles and painting them with an antiseptic solution. The results they had achieved from the application of radium were not very satisfactory; it was a somewhat slow method, and was not one which could be used for dealing with a large number of follicles. Carbon dioxide snow had been by far the most successful of the methods they had adopted there. First, the patient was cocainised, two or three drops of cocaine being put in the eye at intervals of about five minutes, then the CO_2 stick was applied for about thirty seconds. After the snow was withdrawn, the lids were still held back until the snow residue had evaporated from the area of application. The results, he repeated, had been very satisfactory, but a number of applications were needed to rid completely an area of follicles. Intervals of fourteen to twenty-one days were observed between successive applications of the snow. A slight slough occurred, and, after about a week, the whole of the conjunctiva was found to have healed.

Mr. M. S. Mayou:

I would like to say a few words about the histology and pathology of the lymphoid tissue in the conjunctiva, as there seems to be a good deal of misunderstanding about it, and to show you some drawings. When a child is born there is no lymphoid tissue in the conjunctiva. If silver nitrate is applied to the region at birth, then in from forty-eight hours to three days the lymph tissue becomes fully developed. If at birth no irritant be applied, it takes any time between a week and three weeks for loose connective tissue in the fornices to become filled with lymphoid cells. These mononuclear cells are derived, almost entirely, locally from the endothelium of the conjunctiva. This layer of lymphoid cells is normally present in the fornices. Now, if an irritant be applied to, or bacterial infection take place in, the conjunctiva, there is a natural call for more of these cells, and, as a result, there are formed follicles. These follicles are, in structure and function, identical with the follicles which one finds in any lymph-gland elsewhere in the body, and they become the seats of disease in the same way as such glands do elsewhere. My first drawing shows you a so-called follicular conjunctivitis; you see the normal lymphoid layer, and a follicle surrounded by a thin layer of endothelium containing mononuclear cells. These cells are of several varieties—the ordinary lymphocyte, a larger cell, which is known as plasma cell, because the cytoplasm takes deeply basic dyes; endothelial and various other cells in transition stages can also be found. Leading from the follicles there are efferent vessels filled with these cells, which eventually pass into the blood-stream. The reproduction of cells in these follicles is, probably, from the endothelium. The follicle is, indeed, really a minute lymphatic gland which is called into existence by irritation; in a similar way you get a whole fresh chain of glands formed in the neck after they have been removed by operation. When the lymphoid tissue becomes the

seat of disease, for instance, as in trachoma, there is a necrosis, both within the infected follicle and in the lymphoid layer. The most certain clinical sign of trachoma is the presence of scarring in the conjunctiva, so, microscopically, is necrosis of the lymphoid tissue. When these follicles are the subject of trachoma, the disease shows itself in the central part of the follicle, the cells become faintly staining, the plasma cells showing the necrosis most markedly; their cytoplasm is broken up very readily in the presence of any toxin. So that from the centre of the follicle the plasma cells tend to disappear. The breaking up of the cell is manifested by some of the cytoplasm, which stains pink, lying free in the follicle. The breaking up of these cells has led to a great deal of misapprehension. As I have already mentioned, in these follicles there are many endothelial cells which are part of the structure of the follicle—these endothelial cells are strongly phagocytic—that is to say, they pick up the *débris* of the plasma and other cells which are lying free in the tissue and digest them. The *débris* was mistaken for trachoma organisms; it was described as "coccoid bodies," and is nothing more than semi-digested cell nuclei. Later, in the same way, there were little granular bodies found in the cells. I think many of them were nothing but mast-cells with very large granules in them; the granules are free, and they are picked up by these endothelial cells. I do not agree with Mr. Collins's conception of the pathology of a follicle, because if you cut sections of a conjunctiva with trachoma you find many follicles show no necrosis in the centre, and I think they are healthy lymphoid follicles; unfortunately, we have no means of distinguishing healthy from infected follicles. Further, the necrosis may be most marked in the infiltration, and the hyaline material derived from the plasma cell may collect in the tissue constituting Stelwag's brawny œdema. As regards the pathology of the limbus, it is undoubtedly a trachomatous infection, and, in some cases, you get actual follicles formed at the

limbus. This drawing shows a typical follicle at the limbus, from which the plasma cells have disappeared. With regard to the extrusion of the follicle, there is an increased formation of fibrous tissue, and the thickening takes place round the follicle; its subsequent contraction may lead to its extrusion. The next drawing shows the invasion of a follicle with polynuclear leucocytes, and, in some instances, their accumulation may lead to rupture or clearing up of the disease, due to their phagocytic function.

There is only one other point—namely, one which has not been mentioned in regard to treatment, but which I have found very useful. I refer to the use of jequiritol in the treatment of pannus. If it be applied to the conjunctiva, there is a severe membranous conjunctivitis set up, and the condition clears up wonderfully afterwards. Jequiritol is made up in four strengths, but I have used only the strongest one, and I have never had any bad result from it. There is an antitoxin for use if the reaction in any case is found to be too severe. I have never had cause to use that.

Mr. J. B. Story

said he had got the jequiritol preparations, and had tried them with great care, numbers 1, 2, 3, and 4, but had not found any of them of any real good. In his hands they did not produce a decent membranous conjunctivitis. He was in the habit of using the old jequirity infusion in cold water, and he found it a most excellent thing for pannus. In some cases, however, he had used it over and over again before he could get the pannus to clear off. It was also very useful in trachoma itself in obstinate cases which had been treated by expression, and with sulphate of copper, and appeared to be at a standstill. He had never tried carbon dioxide snow for trachoma: he had used largely sulphate of copper. When he first qualified, sulphate of copper was the mainstay of Sir William Wilde for the treatment of

trachoma. The fashionable remedy for that day was ten grains to the ounce of nitrate of silver, washing that off with sodium chloride. He (the speaker) like Mr. Collins, had found sulphate of copper the most efficient chemical remedy for trachoma. Trachoma was pretty frequent in Ireland, though it was much commoner forty years ago there than now. Many cases were seen at St. Mark's Hospital in the earlier days, and many of the patients so suffering were sent up from the country districts with the diagnosis of cataract, or iritis. The cases of trachoma were so numerous that special wards were set apart for these cases, and, as antisepsis was unknown in those days, epidemics of trachoma were not infrequent. On more than one occasion the hospital had to be closed because of an outbreak of contagious ophthalmia. In his personal experience of hospital work, trachoma had died out very much in Dublin ; he was referring to the period 1880 to 1890. Moreover, the cases of it which were seen were not so severe. Then the amount of the disease began to increase, and he thought this was definitely attributable to the efficiency with which doctors in America rejected intended immigrants into that country suffering from anything remotely resembling trachoma. These people came from all parts of Europe, and reached England, but they were not allowed to get further on their journey than Cork, and hence by contagion they spread the disease in Ireland. The serious cases of trachoma seen in Dublin were, largely, in the persons of aliens from Russia and other European countries.

He had much enjoyed seeing this beautiful school for trachomatous children, and he thoroughly appreciated and approved the paper Mr. Collins had read in describing the work carried on here.

Lieut.-Col. Elliot

said that one of the things he had learned to-day was the extraordinary difference of trachoma in severity as met

with in different parts of the world. He had seen a great deal of trachoma: in Madras they used at certain times to get as many as sixty new cases of catarrh of the eyes in one morning; a large number of these were trachoma cases. But apparently it was a different type of disease from that met with here. In the tropics and sub-tropics the diseased patients had mixed infections; it was comparatively rare there to see a man with ordinary quiet chronic trachoma. In the cases in India of catarrhal conditions, silver nitrate was the drug of drugs. In the chronic cases their habit was to rely on copper sulphate. Col. Lister had referred to the number of Egyptians and Chinese coming over who suffered from the disease, and he (the speaker) thought that probably they had the typical type of, and, therefore, a different one from, that seen in, for instance, the patients in that school, although it might automatically be modified when they came to a colder climate. He had one advantage — or disadvantage—over his hearers, *i. e.* he could talk of trachoma from the inside, for he had had it himself. He was engaged in enucleating from a patient a very trachomatous eye, when the eye burst and the material passed with force right into his own eye. He waited until he had completed the operation before doing anything to it. Then the eye was washed out. He developed a mixed trachomatous infection, and he had silver nitrate painting for six weeks. The pain, especially at first, was awful, but subsequently he got more accustomed to it, so that he could have his lids painted with a strength of 10 gr. to the oz. silver nitrate, and do his work in the hospital directly afterwards. Out in India roller forceps were found to be of great value. If the patient would stand it, rolling was done under adrenalin and cocaine, otherwise a whiff of ethyl chloride was given. Once the rolling was over the pain was but slight. For acute and subacute mixed cases in the tropics, silver nitrate was a very valuable drug.

Major Derby (U.S.R.)

said one of the members of the Society asked him, privately, why quiet cases of trachoma were refused admittance into the United States. He thought the answer to that had been supplied by Mr. Story. It was because trachoma existed mostly among the alien population. But there were two great exceptions to that generalisation. A large amount of epidemic trachoma existed among the poor white population in the mountains of middle and south Kentucky and Tennessee. Those white people came from pre-revolutionary stock, a very interesting people. Civilisation had penetrated there very slowly, and they lived in small communities, without much communication with neighbouring people. The Federal authorities had had to go into these regions to establish treatment centres. The other exception was among the American Indians, among whom there was a good deal of trachoma, and the existence of it constituted a rather serious problem.

He could testify as to the efficiency of the treatment of the Chinese in France who had trachoma. He had had the opportunity of seeing a good deal of it, first with Capt. Hine, with whom a trachoma company was followed for two or three months. In addition, Col. Lister gave him the opportunity of going up the line on the expeditions which had already been referred to, and which were always carried out between hours, so that there should be no loss of working hours. This meant doing a good deal of the inspection and work on Sundays, especially as those engaged in the work in the clinics had enough to keep them busy. On the first occasion when he participated, they started off at seven o'clock in the morning and saw 5500 Chinese, and during a part of the journey the party was under shell-fire. They reached home at 12.15 at night. The next time they started at the same time, and he was landed at the door of his billet at 4 a.m. Although the men out there were doing the trachoma work very well indeed, it was the guiding mind

behind, Col. Lister's, which was making the ophthalmic world go round so satisfactorily.

Mr. D. V. Giri

said he assumed the discussion on this occasion was not confined to trachoma. His object in speaking was to bring to the notice of members the drug protosil, an organic compound of silver, which had been placed on the market by Parke Davis & Co. During 1916–17 he dealt with about 50 cases of ophthalmia neonatorum. About 25 of them were treated with a substitute for protargol, which he did not find satisfactory, in spite of exercising the greatest care and diligence in its application. Then he resorted to the use of protosil. He considered the advice sometimes given in such cases by general practitioners to parents to put ointments into the eye with a glass rod or camel-hair brush dangerous, as often the cornea was abraded in the process and led to serious consequences. The best plan was to instruct the nurse or parent to cleanse the eye by first wiping the lids and lashes externally free of discharge by means of wet cotton-wool pledgets, and then holding the lids apart and swilling the discharge out by running the lotion into the conjunctival sac and then to instil the drops. He prescribed a 20 per cent. aqueous solution of protosil to be instilled into the conjunctival sac every two hours for the first few days and as the eyes got better at longer intervals. The lotion used for cleansing was 1 in 20 boric lotion. In cases of marked papillary hypertrophy he rubbed the lids with 1 per cent. silver nitrate solution once a day when the infant was brought to him to make sure of the home treatment. In every one of the cases where protosil was employed the period of treatment was considerably shortened, the eyes getting well in every case without proceeding to ulceration. He had used the same drug as a 5 per cent. ointment as well, in corneal ulcers and in inflammations of the lids and conjunctiva except phlyctenular conjunctivitis, in which mercury is said to be

specially efficacious. It was said to be beneficial in trachoma, but he had had no occasion to try it for that condition. He had found it eminently satisfactory, and where a bacteriological examination could not be carried out and a mixed infection was suspected, he used protosil mixed with zinc sulphate in the form of ointment or drops and found it a very satisfactory treatment.

Mr. J. B. Story

said the President had honoured him by asking him to move the following resolution :

"As large numbers of British troops are now employed in districts in which ophthalmia is exceedingly rife, and as there was an extensive outbreak of ophthalmia amongst the civil population in the country on the return of troops from Egypt after the Napoleonic wars, this meeting of the Ophthalmological Society of the United Kingdom wishes to call the attention of the War Office to :

"(1) The danger of discharging any soldier from the Army who has contracted ophthalmia until he has been certified as cured by an ophthalmic surgeon.

"(2) The danger of allowing any soldier suffering from ophthalmia to mix with the civil population without his having been warned as to the precautions he should take to prevent the spread of infection."

He said it seemed scarcely necessary, in a meeting of ophthalmologists, to make a speech in support of a resolution of that kind. The first statement in it was well known to be true, namely, that the return of the British troops from Egypt after the Napoleonic wars was followed by an extensive outbreak of contagious eye diseases. The disease which was introduced by English troops into England, and by the French troops into France, and similarly into Italy by the troops of that country, spread first from those returning troops to the other troops in the several countries, and thence was conveyed to the civil populations. There were outbreaks of trachoma in France, Italy, Holland, Belgium, Rhenish Prussia, Austria, and

even in Russia. These epidemics persisted for a long time after the Napoleonic wars had ceased. The disease first occurred in Egypt among the French and English troops there ; as soon as the troops landed in the country, the disease broke out. To the credit of the English Army surgeons it must be said they recognised and understood what the disease was, whereas the French certainly misunderstood it, because they reported that the ophthalmia in Egypt did not differ from ordinary catarrhal conjunctivitis except in its intensity. Moreover, they considered that the disease was not contagious. Practically all the English surgeons stated, from the start, that the disease was a specific ophthalmia, and that it was spread by contagion. Nobody now doubted that trachoma is a specific disease, and that it is contagious. Hence he did not doubt that all ophthalmic surgeons would support this resolution. A great dispute went on for a long time on the question of the specificity of the ophthalmia, and whether it was contagious ; the discussion certainly persisted for one or two generations after the disease had broken out in Europe on the return of soldiers from Egypt. Indeed, the controversy was not even yet quite over, for it was asserted by the purists that the disease never had existed anywhere else before it was brought here from Egypt. It was an endemic disease in Egypt before those wars, and the reports of various travellers showed the extreme prevalence of ophthalmia in Egypt before 1800. Ophthalmia epidemics had occurred in armies, and military ophthalmia was known before these wars, but none of the visitations were so fatal and severe as the ophthalmia which broke out in Egypt. After the French troops had been there only a few months, the disease was affecting fully one-third of them, so that in an army of 30,000 men, only 10,000 were sound in this respect.

He had much pleasure in proposing the resolution.

Sir GEORGE BERRY seconded.

It was carried unanimously.

III.—DISCUSSION ON PLASTIC OPERATIONS OF THE EYELIDS.

Opening Paper.

By Major H. Delf Gillies.

I beg to thank you for asking me to give my experiences in plastic operations in the region of the eye, and at the same time I feel that, with the exception of one or two types of operations, there is very little that I can bring forward which will in any way advance knowledge in this difficult branch of surgery. I must also crave your indulgence for my ignorance of ophthalmological matters in general, and I deeply feel my shortcomings in the efforts that I have made in the remaking of eyelids and eye sockets.

In comparing eyelid with other plastic operations around mucous membrane orifices, it is quite possible to produce a new mouth, for instance, to give quite sufficiently satisfactory appearance and function without its correct muscles; but to make eyelids without the musculature or without the lid margins is an impossibility as far as my efforts have gone. In regard to the upper lid, no satisfactory result can be obtained unless the levator muscle is active.

There are, thus, two types of plastic operations to lids and sockets which I have found useless owing to want of movement of lids or to the absence of lid margin.

(1) Where the levator palpebræ superioris muscle action is absent:—I have only had one patient who was glad to wear an artificial eye when the upper lid did not move.

In one case I have shown to-day, and whose pictures

I will demonstrate presently, an effort was made to make a complete upper lid where the loss was total. That I have produced something in the form of an upper lid is, I think, an interesting effort which, in the hands of other surgeons, may be developed still further.

Where the muscular action of the lower lid only is missing, I think it is quite possible to make a satisfactory socket.

(2) Where the lid margin of the upper lid is lost, no really satisfactory substitute for the eyelashes has been obtained in any of my cases. By including a margin of hair from the eyebrow, a hairy edge has been produced, but these hairs are a long way different from eyelashes.

I do not think that the loss of the lower lid edge is any contra-indication to plastic operations; a satisfactory lid can, in most cases, be obtained.

Similarly, the loss of the infra-orbital plate or of any portion of the orbital ring can be satisfactorily reconstituted by muscle, fat, or cartilage grafts. Cases to illustrate this have attended this afternoon, and will be further demonstrated presently.

Ectropion Conditions.

This hitherto intractable deformity has been, I think, definitely solved by my development, which I believe is original, of the skin-grafting method devised by Esser.

To those of you who are not familiar with the Esser *epithelial inlay*, I will briefly describe its technique. It was devised for entropion conditions of any mucous orifice, such as turned-in lower lids, for increasing the depth of the buccal sulcus, for enlarging the eye socket, etc.

In Esser's description applying to the eye socket—supposing it is wished to deepen the lower fornix, an incision is made from the outside into the lower lid and deepened until the deep surface of the conjunctiva is reached. The scar tissue which is found in this situation, due to the injury, is then dissected carefully off the

deep surface of the conjunctiva; some sterilised dental composition is then taken, and the mould of this cavity then prepared. When the mould is made, the skin edges are drawn together over the mould in order to ascertain whether it is of the right size for getting approximation of the skin edges. If it is too big, it is cut down until the skin edges meet. The mould is then taken out of the cavity and a freshly-cut Thiersch graft from the inner side of the arm is wrapped around the mould, which is then placed back into position into the cavity, the epithelial surface of the graft being towards the mould. The skin edges are then united over the mould and skin graft, which are there buried for some ten days. At the end of this time, an incision is made through the conjunctiva at the spot where the scar tissue was removed. Immediately underlying the conjunctiva will be found the skin graft, and then the mould. One blade of a pair of scissors is now inserted into the cavity in which the mould is lying, and the incision in the conjunctiva thus widened to the full extent of the size of the mould. The mould can now be easily removed, and it will then be found that the cavity in which it is lying is absolutely perfectly epithelialised on all its aspects, and the only raw surface to contend with is the small area lying between the skin graft and conjunctiva. A prosthetic piece should be immediately inserted into the cavity to retain its size and shape and to keep its opening into the eye socket widely patent. This is of great importance, and the nearer the inlay is put to the conjunctiva in the first instance the less raw area there is to heal over.

In one case in which the inlay did not sufficiently approximate the conjunctiva, the opening into the epithelialised cavity closed up, and the operation was a failure.

From a quite extensive experience of these inlays, I feel they are of great value, but that they have to be done with very great care as to detail, and the surgeon must be prepared to insert immediately from the eye socket a

FIG. 1.

Case 1. (*a*) Contracted socket.

FIG. 2.

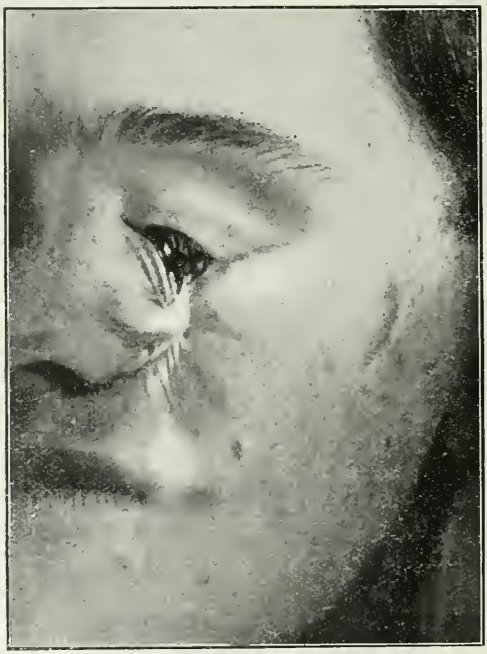
Case 1. (*b*) Esser inlay enlarging socket

prosthetic piece to fill the epithelialised cavity until it is firmly established.

GROUP 1.—*Cases showing the Esser epithelial inlay.*

CASE 1 (Lieut. T—).—Examples of epithelial inlays—Esser method. Lieut. T—, contracted socket, deformity

FIG. 3.



Case 2. (*a*) Condition.

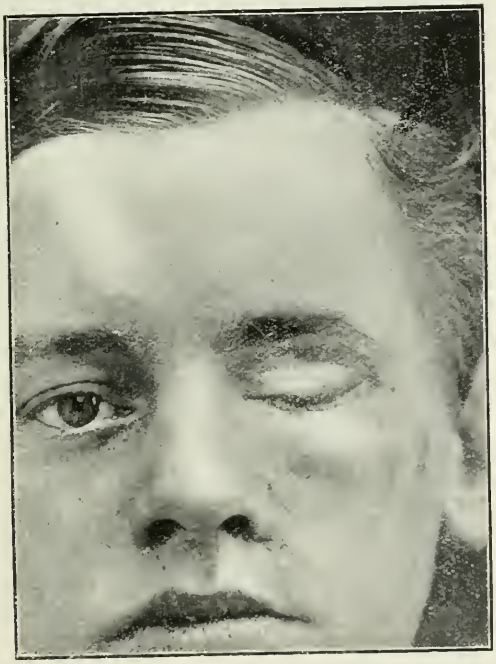
of margin, upper and lower epithelial inlays. Lower a failure due to not inserting prosthesis. Upper successful in carrying an eye. Slight ptosis prevents a satisfactory appearance.

CASE 2 (Pte. K—).—Loss of lower lid, infra-orbital plate, and soft tissues. Inner half lid margin remains. Skin and fat flap operations. Outer canthus contracted.

Epithelial inlay inserted to deepen socket and to widen palpebral fissure.

Case 3 (Lieut. N. S—).—Attempt to form lower lid and eye socket. Very slight movement of upper lid only. After getting the eye into condition shown in the third photograph, the tissues in the situation of the lower lid

Fig. 4.



Case 2. (*b*) After cheek plastic.

were epithelialised on their deep surface by the inlay method. Patient has been shown to-day.

Case 4 (P—).—In which there is orbicularis and levator action present, but no lid margin and no conjunctiva. I have attempted to make socket by inserting a matched artificial eye covered with epithelium. The palpebral fissure will only be opened a little at first to allow epithelial

desquamation until there is no chance of retraction. I do not expect much movement out of the lids, but hope that out of this operation something more may be done to further the remaking of eyelids and eye sockets.

I feel that it is only by going on trying that we shall

Fig. 5.

Case 2. (*c*) Same stage, showing small socket.

ever be able truly to remake eyelids and sockets, and many of these experimental operations may, if recorded, be of some benefit in the future to the thousands of damaged eyelids that exist to-day, which is my justification for doing an operation which has little, if any, reasonable prospect of success in its present stage. If, however, as much improvement in eye sockets and eye plastics has already been made by other surgeons, or is going to be

made in the future, as has occurred in rhinoplasty during the last six months, things that appear quite impossible to-day become commonplace to-morrow.

Arising from this method, invented for entropion conditions, I developed an operation for ectropic conditions

FIG. 6.

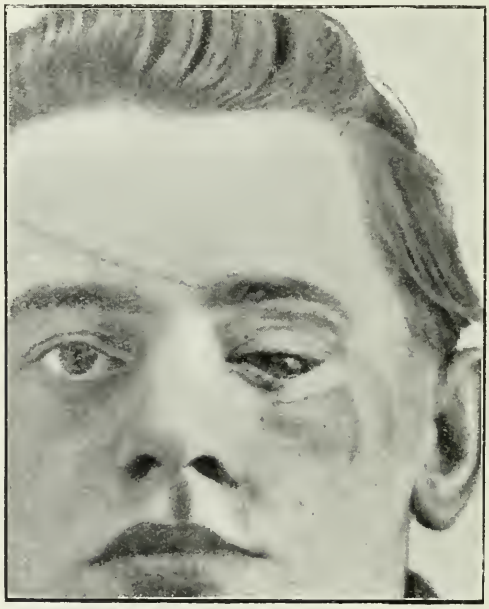
Case 2. (*d*) Esser inlay to enlarge. Dotted line represents position of inlay; mould and graft *in situ*.

(which I have called "an *epithelial outlay*"), and which I feel you will agree is of great value to this section of the work. I believe that many an eye could be saved by the timely application of this new method. It is, roughly, the converse of the inlay. My first idea was to insert it from the mucous membrane side and to remove it from the skin side of the lid, which would be the exact con-

verse of the treatment for entropion conditions ; but the necessity for the complication of inserting it from the mucous membrane side was not apparent, so that I insert it from the outside and remove the mould from the same incision.

For ectropion of the upper lid, a curved incision is

FIG. 7.



Case 2. (*e*) Mould removed. Shell inserted.

made just above the lid margin. This is deepened slightly, but not down to the tarsal plate, and care is taken as far as possible to avoid interference with the levator palpebræ superioris muscle. To a certain extent, the flap of skin lying above the incision between the incision and the eyebrow is undercut. This undercutting is continued until the lid margin descends to a lower level than normal.

A mould is then taken of this cavity, covered with skin graft in the same way and the skin united again at the

original incision. When the skin is thus sewn up again over the mould, the ectropion is more pronounced for the time being until the mould is removed. This incision is not tightly closed, so that there are one or two gaps in it which allow the new epithelium to grow around the margin of the incision. In some of the cases I have deliberately reopened the incision and removed the mould on the tenth day. The lid now drops below the normal level, and the ectropion is permanently cured.

In others of the cases I have been in no hurry to remove the mould, and the incision gradually opened of its own accord until there were only one or two small bridges of skin holding it in position. These can easily be cut without anæsthetic. After the mould is removed there are certain disabilities that become apparent. There is no doubt as to the cure of the ectropion, but if a nice edge has not been produced, there is the appearance of an epithelialised ulcer which, however, in the course of time, softens out remarkably with massage and the natural movement of the lid. The outlays in the upper lids give a very neat appearance, in some of the cases imitating very naturally a normal lid.

In reviewing the procedure, it is merely a very satisfactory method of inserting the skin graft into the lid, which allows the lid margin to return to its normal position. I have never had the occasion to use it on an acute case where it is necessary to cover the eye at as early a date as possible in order to save the sight, but I have no doubt that it can be successfully performed for this purpose in such conditions as burned eyelids, in which, in order to give the eye a chance, it was necessary to get the upper lid over the cornea. In these conditions it would be quite possible to obtain a result in about five to seven days.

GROUP II.—*Cases showing the epithelial outlay.*

CASE 5 (G—).—Cordite burn—eyelids and nose. Preliminary plastic operation at the Cambridge Hospital,

Aldershot, to replace scar tissue of nose and to allow inner canthi to recede. Epithelial outlay of lids, upper and lower lids on the left side, lower lids on the right. The first case recorded.

Case 6 (A.B. V—).—Cordite burn at the Battle of

Fig. 8.

Case 5. (*a*) Cordite burns. Ectropion.

Jutland. Whole face—nose, eyelids, eyebrows—burned. Ectropion lids. Photograph showing transference of skin from chest to face. Pedicles detached from chest. Left-hand pedicle swung round to obtain tissue on nose. Eyelids showing ectropion open, closed. Upper lids treated by outlay method, showing the appearance of these outlays immediately after they had been removed. It was intended originally, before I designed this outlay opera-

tion, to swing the remains of his pedicles to his eyelid region. This is now unnecessary. Outlays will be performed for the lower ectropion.

Case 7 (Pensr. S—).—Cordite burn. Attempt at closure. Eyes open—lateral view. View of epithelial

Fig. 9.

Case 5. (*b*) After plastic.

outlay at the moment of the mould being removed. Mould still in position on the left side.

Case 8 (Capt. B—).—The last of this series is really only an extension of this method. The condition of this officer shows complete absence of all tissues of the upper lid. The conjunctiva was joined by scar tissue to the depressed and damaged eyebrow. By an extensive epithelial outlay above the levator muscle an attempt to

make a lid has been made. The lid margin was supposed to include a few hairs of the eyebrow. By rearrangement of the lid margin a moderately satisfactory appearance

FIG. 10.

Case 5. (*c*) After "outlays." Date of operation, November 23rd, 1917. Date of photos, June 8th, 1918.

has been obtained. I have the satisfaction in this case of knowing that one of your best known members who saw this case before operation kindly but firmly intimated to me that I was attempting the impossible. The case is unfinished, but is one which, to my mind, is full of hope.

Case 9 (Lieut. F—).—Col. Newland, D.S.O., A.A.M.S., head of the Australian Section, Queen's Hospital, has kindly permitted me to show this case as an example where the epithelial outlay method will be of service. The burn is due to nitric acid.

Fig. 11.

Case 6. (*a*) Marked ectropion, all four lids.

Cartilage Prothesis.

The next class of case that I have the honour to bring to your notice is that of the employment of a cartilage prothesis to produce good mobility of the artificial eye and good projection. This method was described by Carlotti and Bailleul of Paris in 1915. In 1917 Capt. J. L. Aymard described an operation which is an inde-

pendent modification of this method. The technique was described by him in the *Lancet* of October, 1917, and consisted of inserting into or through Tenon's capsule a couple of discs of cartilage shaped to form a globe. I

FIG. 12.

Right. Left.

Case 6. (*b*) Before operation.

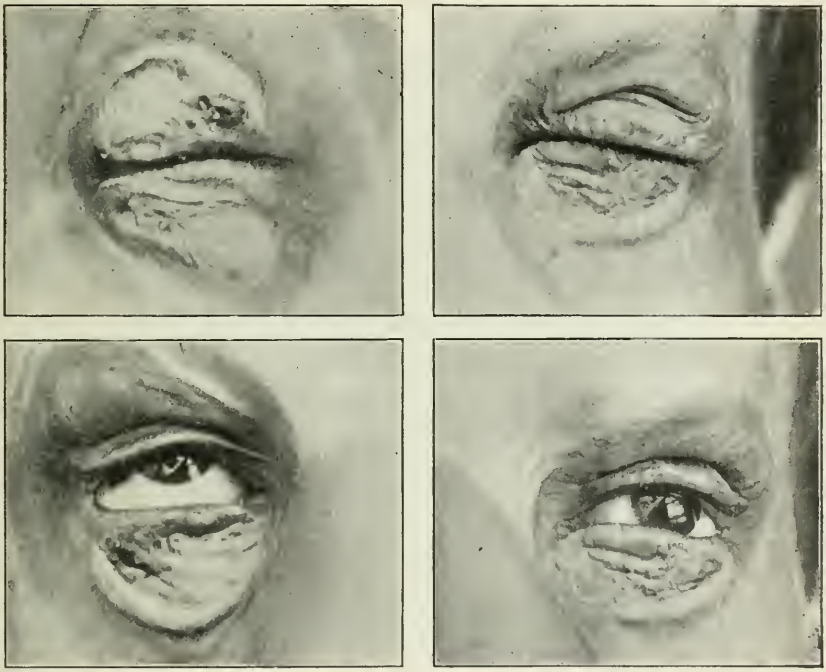
have to-day to show you six cases in which this cartilage prothesis has been performed by me. I have slightly modified the shapes of the cartilage, the most interesting of which was in the following case :

Enucleation of the eye was advised by Capt. Carruthers, of the Royal Herbert Hospital, and immediate cartilage prothesis was inserted at the time of operation. It was inserted in two pieces in the form of a cup and ball, as shown in the diagram (Fig. 14). The cup was conical, and

extended back to the apex of the orbit. The ball fitted into the cup at the extremity of this cone-shaped piece of cartilage. Into the cartilaginous ball was inserted each of the six ocular muscles by means of thread sutures into their

FIG. 13.

Right. Left.



Case 6. (*c*) After epithelial outlays. Note: upper grafts already smoothed out, lower recently done. The marked lower ridge has since been excised.

approximately normal positions on the globe. The conjunctiva was sewn up over this cartilaginous ball with thread.

I had intended to use fine catgut for suturing the muscles to the cartilaginous ball, but for the moment a supply was not available. The thread sutures caused a

certain amount of trouble and were partly exfoliated. Despite this and the consequent slight ulceration of the conjunctiva over the cartilage, the socket rapidly cleaned and healed over the cartilage. The projection and movement of this eye are moderately good, and would probably have been better had I used catgut.

This cup and ball prothesis has been used by me in a

Fig. 14.

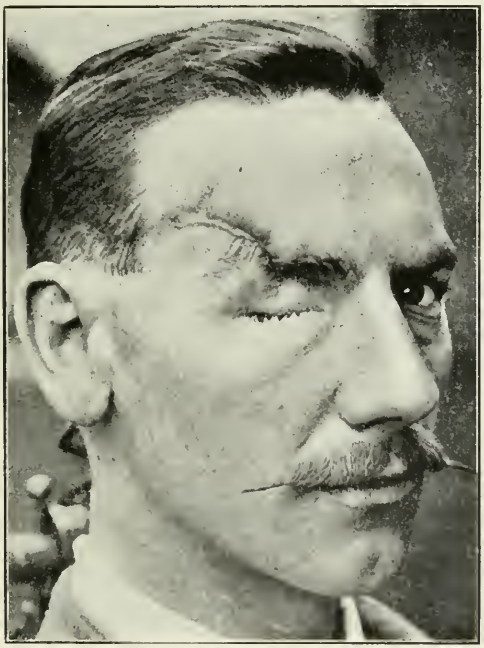
Model of cup and ball cartilage prothesis. Ocular muscles stitched to the cartilage.

number of late cases of shrunken socket, and seems to give satisfactory results. The cartilage is obtained from the sternal end of the 7th right costal cartilage. I use the sternal end because here the cartilage is thicker from before backwards than it is at its rib end. By running the knife round when the cartilage is removed, the cup and the ball can be cut with the one action. My idea was to get full projection of a moderately small cartilage globe which would give good movement.

GROUP III.—*Implantation of cartilage into eye sockets.*

CASE 10 (Sergt. B—).—Late implantation of cartilage into shrunken eye socket. Cartilage similarly implanted in infra-orbital region. Movement and projection of eye good.

FIG. 15.



Case 12. (*a*) Condition.

CASE 11 (Lieut. E—).—Late implantation of autogenous cartilage graft—globular shape in two discs. Result not shown. Patient has attended.

CASE 12 (Sergt. B—).—Late cartilage to eye—autogenous, oval-shaped. Cartilage restoration of superciliary margin.

CASE 13 (P—).—Late cartilage—cup and ball. Patient has attended to-day. Good projection.

Case 14 (L—).—Diagram to show method of immediate implantation of cartilage. Had operation for enucleation of eye. Ocular muscles . . . stitched to cartilage globe.

Case 15 (Capt. V—).—This photograph is shown to

Fig. 16.

Case 12. (*b*) Cartilage to socket cartilage to replace lost frontal bone.

illustrate the method of cartilage carriers. This officer patient required cartilage for his nose, and in order to save more than one rib operation, sufficient cartilage was taken for the nose and eye at the same time. A spare bit was also taken. These three pieces of cartilage were inserted subcutaneously into the abdominal wall for future use. He has still two left, but one has been used in the nose and one in the eye. The eye socket is not

yet satisfactory owing to contraction and lacrymal sac trouble.

Although this cartilage operation leaves no permanent disability, it is painful, and I have tried on three occasions to develop the epithelial inlay method to substitute

FIG. 17.

Case 18. (*a*) Condition.

the cartilage ball operation thus: A Mules globe is taken and inserted into the socket, through a horizontal incision in the conjunctiva, as in the cartilage operation. The ball is inserted, to see that the cavity made is sufficiently deep to allow the conjunctiva to be resewn over it. It is then taken out and covered by a freshly-cut skin graft, which is sewn tightly, with catgut, round the glass ball, so as to enclose it completely, the skin surface towards the glass. This is then inserted, and the con-

junctiva sewn up with horsehair. It was expected that in the course of ten days to a fortnight that the secretion and desquamation from the skin graft would find its way through the conjunctival incision, and it was hoped that the Mules globe would then remain inside this epithe-

Fig. 18.

Case 18. (*b*) After excision scar, temporal muscle flap, cheek flaps.

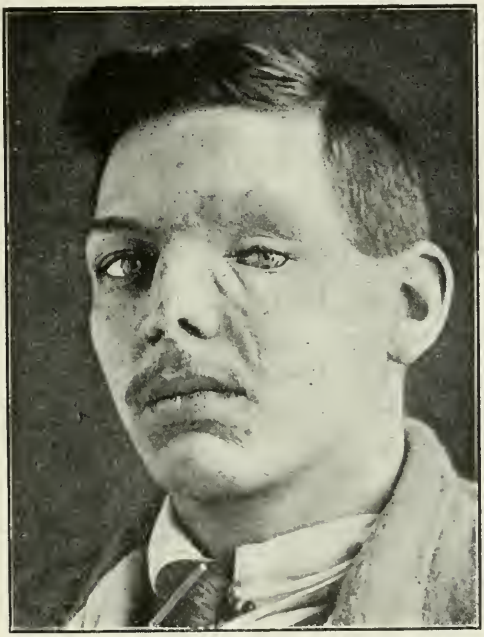
lialised cavity, with a portion of its anterior surface exposed to the eye socket. Over this globe could then be fitted a very satisfactory artificial eye.

In the first case I tried, the conjunctiva was not sufficiently closed off to retain the globe. A portion of the skin graft remains as a depressed epithelialised area in the back of the eye socket.

In the second case the glass ball was extruded by

pressure of secretion from its cavity on about the eighth day. Into the cavity was inserted by Capt. Malleson for me a vulcanite globe, and to keep this cavity open the vulcanite globe was retained in the manner shown. The patient has attended to-day.

Fig. 19.



Case 18. (*c*) Thin cartilage plate to support lower lid.

In the third case the glass globe was retained for five weeks. At the end of this time a minute area of the glass globe only was exposed, and everything seemed quiet and comfortable. The patient was fitted by Mr. Taylor with a glass eye over it, and the result in appearance was most satisfactory. However, this glass eye seemed to stick very much to the Mules globe by suction, and three days after it was fitted, the globe, to my intense

disappointment, was expelled. During these few days a small adhesion had been divided, and with the various manipulations and the taking in and out of the artificial eye a certain amount of sepsis had occurred, which probably determined the expulsion of the globe. The

FIG. 20.

Case 19. (*a*)

glass globe had been inside its epithelial cavity for five weeks before being extruded, and I hoped very much to have shown the case, but unfortunately it was expelled ten days too soon.

Of other plastic operations in the neighbourhood of the eyelids, I find that the temporal muscle flap, swung forward when there is loss of the malar bone, serves as an excellent bed on which to graft later a cartilaginous

orbital ring. It gives good contour, and produces an expression due to the action of the temporal muscle in its new situation.

Patients have been shown to-day exhibiting this movement.

Fig. 21.

Case 19. (*b*) After temporal muscle, neck skinflap and cartilage grafts.

Ectropion treated by flap methods is satisfactory in some of my cases, but since the development of the "outlay" method I have abandoned flaps.

In order to support the lower lid at a higher level, a thin rod of cartilage may be inserted from side to side just below the lid margin.

Similarly, for facial paralysis, I wish to bring to your

notice the possibility of development of this latter method for its relief.

I suggest that a piece of cartilage of the necessary length be split like the wishing-bone of a fowl without complete detachment at one end; the two halves would

Fig. 22.

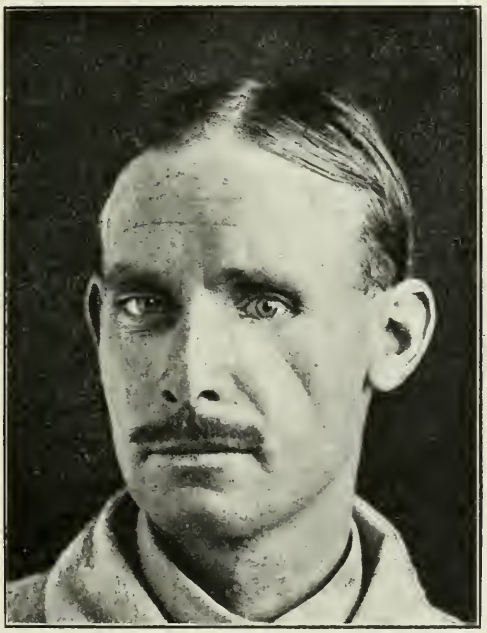
Case 21. (*a*) Bullet wound.

thus have a springing tendency to close. They should be inserted through a small incision at the outer ocular angles, and pushed along subcutaneously beneath and below the upper and lower lid margins respectively. When the internal ocular angle is reached a further incision should be made, and the ends of the cartilage brought together and sutured with the necessary tension to obtain a good covering to the eye. The skin incisions could then be closed. A certain amount of ptosis would

thereby be produced, but the eye would be protected from irritation.

An interesting experiment was carried out by Major Waldron, C.A.M.C., on similar lines by muscle, and I hope will be explained by him.

Fig. 23.



Case 21. (*b*) Cheek plastic + cartilage to socket.

I have had no suitable case on which to try this cartilage method, and would be very glad of one.

Cases.

Group IV.—*Cases showing the Implantation of Fat, Muscle, Cartilage, and Skin Flaps from other Regions.*

Case 16 (W—).—Depression in malar region, treated by

temporal muscle flap. The lid could further be improved, preferably by epithelial outlay.

Case 17 (F—).—Malar depression, treated by temporal muscle transplant. This muscle is still in a contractile

Fig. 24.

Case 24. (*a*) Severe cordite burn.

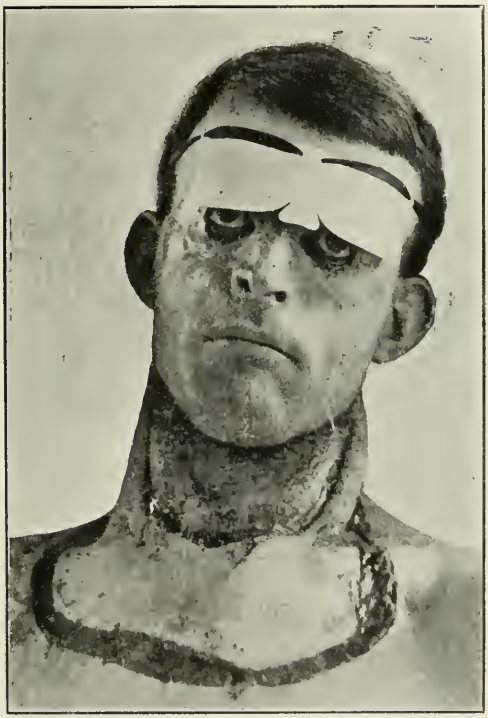
condition—a year or more after its transplantation. The lower lid could be easily improved.

Case 18 (W—).—Loss of left eye, infra-orbital plate, and malar prominence. Treated by (*a*) temporal muscle, (*b*) cheek flaps, (*c*) cartilage implantation to support lower lid.

Case 19 (T—).—Large loss of infra-orbital plate, superior

maxilla, hard and soft tissues of cheek, œdema lower lid. Treated by temporal muscle transplant, skin flap from lateral neck region. Cartilage from another patient inserted in four pieces—one for the lower jaw, two for the

FIG. 25.



Case 24. (*b*) Preparation of neck pedicles to convey chest flap.

orbital ring, and a thin rod passed along from outer to inner canthus below lower lid margin to support same.

CASE 20 (M—).—Acid burn causing ectropion, upper and lower lids, and eyebrow damaged. Cheek flap methods. Cure of ectropion. Satisfactory appearance, with the addition of a cosmetic eyebrow.

CASE 21 (Capt. H—).—Re-formation of lower lid by

cheek flaps. Support of new lid produced by subcutaneous fat flaps. Cartilage prothesis inserted under local anæsthetic to produce fulness of socket.

Case 22 (J—).—Ptosis of left upper lid. Partially replaced by flap methods. Plastics to nose and mouth.

Fig. 26.

Case 24. (*c*) Flap in position.

Case 23 (E—).—Loss of lower lid, ptosis. Some loss of bony floor orbit. Repaired by temporal flap, which was rolled in on itself. Eye set much too low and no movement to lid. Patient satisfied to wear eye without bandage.

Case 24 (Y—).—Case of severe burn of the upper half of the face, which was one mass of scar tissue from the level of the nose upwards. Replaced by large flap from

chest. Lid margins and eyebrows preserved. It will be necessary to adjust the palpebral fissures.

In conclusion, nearly all plastic work is, to a certain extent, experimental, and inferior as I regard my eye plastics to be in comparison with those of other regions of

FIG. 27.

Case 24. (*d*) Pedicles returned.

the face, I trust that the experimental work that has been done may be of some permanent use to this difficult art; and it is really encouraging that from one of these experimental operations, viz., that of the epithelial outlay, a cure for ectropic conditions has definitely been obtained.

Opening Paper.

Operations on eyelids.

By C. Higgens.

Mr. Higgens thanked the Council for the compliment paid him in asking him to partake in the discussion, though what Major Gillies had said was so complete that but little was left for him (the speaker) to add. What he had had to deal with most were shrunken sockets and all kinds of scars about the face and nose. He had not had to deal with many of the very severe injuries Major Gillies had just demonstrated.

As he did not propose to go into details, the best thing he could do was to speak in general terms on the subject. For a long time he tried to make good deficiencies by the use of other bodies, such as pieces of celluloid, and he had contributed to the *Lancet* an article on the use of celluloid for such cases of deformity. At first he was somewhat favourably impressed with it, but eventually he found it would not do. In two cases the patients certainly went away with respectable-looking noses, but in others the edges of the celluloid plates worked out and it was necessary to remove them. He also used fluid celluloid and paraffin, but it was not long before he gave the paraffin up, though he continued to inject fluid celluloid under scars for some time longer. His present conclusion was that the only way to treat these cases successfully was by transplanting a piece from the patient's own anatomy, or, failing that, living tissue from another. For a time he felt diffident about doing plastic operations, such as Major Gillies had been describing—*i. e.* removing portions of cartilage, grafting, etc.—because in former days, if a surgeon made a further wound on a man already wounded, he would be liable to be indicted for malpraxis, and if, as was likely, the patient died, a trial for manslaughter would probably have ensued. He had not tried to implant bone,

but he had used cartilage, and he had found it most satisfactory. What he always aimed at was to use tissue from the vicinity, turning up a flap with a pedicle. If a man had practically lost a lower eyelid, he dissected up what remained, put it in place as well as possible, and covered it with a flap of skin. He thought it was very important to avoid using scar tissue. Sometimes he burrowed under scars and put beneath them a sheet of Cargill membrane, and that had acted very well. Where possible, it was better to cut away every bit of scar tissue and bring edges accurately together. One thing he had done, which answered excellently for sockets, was to replace conjunctiva by conjunctiva, and that could generally be managed in a big war hospital, because, unfortunately, there were always a certain number of men who had lost their eyes, and whose sockets were so damaged that nothing could be done to restore them, and the conjunctiva left was available for other cases. One of his favourite operations was similar to one described by Major Gillies. Where there was good skin, he took a piece and dissected it up, leaving a pedicle close to the outer canthus; he then bored a hole underneath the outer canthus, pulled the piece of skin in, fixed it in position with sutures, and stuffed the cavity with gauze, and repeating the stuffing until all was healed. A tunnel, of course, was left under the lid, but he did not think that mattered. Sometimes, however, there was a cheesy secretion from it, which was a discomfort. As a rule, it closed of itself; if not, he slit it up and sewed the margin to the edge of the flap. Filling of large depressed cicatrices he carried out by using pieces of muscle or other tissue taken from the same patient. In one case, at the instigation of Major Gillies, who happened to be present, and said, "Why don't you put that man's temporal muscle into his face?"—he had done it, and the case did very well. He simply cut through the skin all round the temporal ridge, turned the flap down, then dissected the muscle from the temporal fossa, turned it down, and cut the attachments away, except that to the

coronoid process, then tunnelled under the scar and pulled the temporal muscle beneath it. The scar extended so far that it involved the man's mouth, and his teeth were exposed in the wound. Having got the temporal muscle into the main scar, he sewed it up. There was very little reaction afterwards and but slight discharge. The end of the wound which exposed the teeth was dealt with later. After healing, which was good and complete, there was but little deformity ; indeed, anyone looking at the man full-face would not know on which side it had been done. He might add, while feeling that he could not add anything material to what Major Gillies had so well said, that no hard-and-fast rules could be laid down in regard to plastic operations ; each case should be regarded as one which was peculiar in itself. He did not feel that he had seen two cases really alike in his experience. Certain things were essential. For example, a man who set out to do these plastic operations must possess a certain operative capacity, a considerable degree of manual dexterity, ingenuity in planning, and, above all, unlimited patience. Any one operation itself might take any time up to two or three hours. He always used antiseptics, but he considered it was impossible to keep the eye, nose, etc., aseptic. It was extraordinary how wounds in the face healed, even when it seemed there was no chance of healing taking place. He believed soldier-patients were better material than was usually the case in civil practice.

Opening Paper.

Masks for facial wounds.

By Capt. Derwent Wood.

Capt. Derwent Wood said the work he had been engaged in in connection with wounded soldiers was more in the nature of sculpture ; it had no real connection with surgery. He had been engaged in making artificial masks

to take the place of missing portions of the face, and in many of the cases with which he had had to deal the surgeon had said nothing further of an operative character should be attempted. He had done what he could in about 100 such cases. It was purely a question of how well the work was modelled in his work, and, to some extent, the cosmetic effect depended on how nearly the colouring was a match for that of the natural skin. For the appearance of the patient a great deal depended on the exactitude of the fit. One drawback to the masks was that they were necessarily delicate, and hence they got damaged quickly. He did not know how these cases which wore these masks would go on after the war, unless they learned how to repair the fittings and masks themselves. But perhaps by that time all the cases which Major Gillies had so splendidly dealt with would have become so well known as living instances of what could be done surgically that all would seek to come under his ministrations, as it must be always much finer to have a real nose on one's face than an artificial one. It was a pleasure to him (the speaker) to feel he had done some good for these poor mutilated men. He would not detain the meeting by entering into the detail of his work, especially as the demonstration would have, to some extent, served that purpose.

PROCESS.

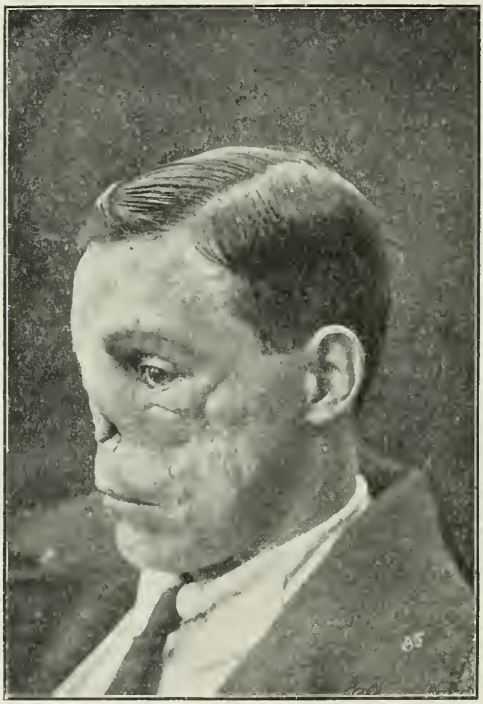
(1) *Casting patient's face.*—It is essential that a good fit on the edges of the plate should be secured; to this end a plaster mould of the face is obtained.

In the case of Driver F—, and in consideration of the nature of his wound, I filled the cavity with his usual dressing, cotton-wool, covering this and his left eye and eyebrow with gold-beater's skin, bandaging all portions of his head that were not wanted in the mould; his nostrils were blocked with cotton-wool, the patient during the casting breathing through his mouth, and being seated with head thrown back and pillowed on a box. After the

exposed portion of face has been oiled, the plaster is mixed with tepid water and applied. In five minutes the mould is removed, bandages stripped, and the patient cleaned up.

(2) *Modelling.*—The mould having been obtained, it is dried, French chalked, and a clay or plasticine squeeze is

Fig. 28.



Appearance before mask is applied.

obtained from the mould, giving a positive model of the patient's dressed wound and the surrounding healthy tissues; this is fixed to a board on a modelling stand and a sitting from the patient with undressed wound is obtained. Modelling now commences, and such art as the sculptor may possess is brought to the test. A reconstruction of the wound in every detail is established,

taking care that the depths and widths of the wound are accurately measured and modelled. The sculptor having completed his model, he proceeds to cast it, and procures the plaster positive of the wound and its surrounding structures. Another sitting is obtained, and the portions

Fig. 29.

Appearance with the mask on.

which are to be hidden eventually by the metal plate are modelled in clay or wax, the edges being blended to the uninjured portions of face, thus effectively masking any trace of wounds. This is once more moulded in plaster, and the edge of proposed plate being marked on the negative, a cast is obtained, edges are trimmed to marking, and the model is ready to have the artificial eye fitted

to the lids; this is done from the back of the model. The plaster eyeball is dug out, the requisite thickness of lids is carefully worked down, the glass eye placed in position, and the edges of the lids made good with thin plaster.

(3) *The plate.*—The model is now taken to the electrotyper, where an exact reproduction by galvano-plastic deposit is made in virgin copper $\frac{1}{32}$ in. in thickness. This is finally well coated with silver. Thin bands are soldered in on the back to clamp the eye in place. The plate is again fitted to patient; strong spectacles are adjusted at the requisite angle to give a well-distributed pull on the plate. In the case of a large plate being used, an elastic band around the back of head is necessary.

The final sittings are devoted to the pigmentation of the plate. I have found a thin coating of cream-coloured bath enamel a good preparation for flesh-colour matching, as it leaves the oil-colour matt when dry, which is essential to the illusion of a good blending of plate with face; should the patient have shiny skin, this is easily obtained by varnish rubbed down to match the skin.

I have tried false hair on eyelids and eyebrows—they will not stand the weather—and have adopted tinfoil split with scissors and soldered into lids for the eye, and, for the eyebrows, pigment applied to the modelled forms.

The case figured in this issue was handed over to me by the Commanding Officer (Lieut.-Col. Bruce Porter); these cases are necessarily of an experimental nature.

A good deal of time was spent in making the masks; henceforth a month would cover the completion of similar appliances.

Opening Paper.

By T. Harrison Butler.

The fascinating account which we have just heard from Major Gillies of the new methods he has devised and employed at Sidcup, and the astonishing results which we have been able to examine, makes it essential for me to modify the remarks I had intended to make, for in many respects they dealt with what we must now regard as ancient history.

I have been especially interested to hear of the new procedure devised by Esser for skin grafting. My results hitherto obtained by the Wolf method have been somewhat disappointing. The cosmetic effect has not been so pleasing as that gained by the use of pedunculated flaps, and the time taken has been much longer. In consequence I have only chosen the Wolf method in cases of severe burns, when the condition of the surrounding skin has prohibited the use of flaps; in fact, I have only grafted when I have been driven to do so. I believe that most Continental surgeons hold a similar opinion, though grafting is popular in America. It seems to me that the clever devices elaborated by Major Gillies open up an entirely new era, and that now an epithelial outlay will be the operation chosen for many cases which up to the present have been treated by grafting or by flaps. The inlays will enable one to deal effectively with contracted sockets, which have long been the despair of ophthalmic surgeons. I hope to start upon the Esser method at once.

The deformities we have to deal with may be remedied by four procedures—by grafting, by the Esser plan, by the Wharton Jones V. Y. operation, and by the use of pedunculated flaps.

The V. Y. operation appears to be suitable only when a small effect is called for, and even in simple cases it has failed to render the help anticipated: although apparently

a less formidable procedure than the flap operation, yet it has in practice often called for repeated operations, and the resulting cicatrices have been more obvious than those which follow the flap operation. As an example of this I show you a photograph of a soldier upon whom I performed a Kuhnt* operation, which is, after all, but a modified V. Y. operation. In this case the lower lid was drawn down about an inch, and was firmly attached to the bottom of a pit which had followed a shrapnel wound. The fragment had fractured the malar bone, and there was considerable loss of osseous tissue. The conjunctiva formed a large œdematous swelling. The cicatrix was cut away and the cavity filled with fat from the gluteal region. The operation was completed by the procedure described by Kuhnt. As is usual in this type of operation, there was a certain amount of tension in the sutures, and some suppuration took place in the implanted fat. Eventually I was compelled to use a pedunculated flap. I found that the fat had changed to a fibrous mass, completely filling the cavity. The final result was good, but, as shown in the photograph, there is considerable obvious cicatrisation. I think that had I used a flap at the first operation the result would have been better and probably completed in one stage. On the whole I am of the opinion that the V. Y. method should be reserved for trivial displacements of the lids. An essential factor in a plastic operation, under conditions which are rarely even approximately aseptic, is the absence of any tension in the sutures. If any suture be in tension the result is "on the lap of the gods." The flap method absolutely avoids tension, and in consequence practically never fails. Even should a certain degree of suppuration ensue, the final result is not materially prejudiced. I think that the flap method should be the general operation of election, and if judgment be exercised in cutting the flap, the resulting scar is practically invisible.

The cases we have to attack fall into two main groups:

* See *Brit. Journ. of Oph.*, November, 1917.

Displacements of the lids, and loss of lid substance. The displacements from a therapeutic stand-point may be divided into retractions of the temporal aspect of the lids, and of the nasal aspect. The former are comparatively easy to remedy, the latter may be very difficult. All these deformities may co-exist. It is best to treat a complicated case by degrees, and not try to do too much at once. The usual operation I have performed is the following: A horizontal incision is made along the displaced lid edge, upper or lower, sufficiently long to allow the lid to return to its normal position, and then all cicatricial bands are carefully and thoroughly divided with strong blunt-pointed scissors. Extreme care must be taken not to open the conjunctival sac. To do this is to court endless trouble later on. The length of the raw surface exposed and its breadth are now measured with compasses, or a template can be made of tinfoil, and a flap marked out in an upward direction which will fill the defect. I cut an upward flap for both upper and lower lid. A downward flap is employed only when both lids are displaced. The upward flap leaves no visible scar; the downward flap, cut from the cheek, leaves a slight cicatrix. The flap is carved with its inner side close to the outer canthus, and is curved to follow the natural furrows of the skin. It will generally include the outer portion of the eyebrow. The top of the flap is left blunt; a pointed flap often sloughs at the tip. The skin and subcutaneous tissue, as much as comes naturally, is included. The base is separated only so far as is necessary to avoid a pucker at the twist. A defect is now left on the temple. The outer edge only is undermined, and the vertical wound is closed at once to limit the hæmorrhage which confuses the subsequent steps. By undermining only the outer lip of the wound the resulting scar is brought into the wrinkled skin near the eye and becomes invisible. If the cicatrix fall further out it may be a disfigurement. The flap is now rotated through 90 degrees and sutured into the defect below or above the lid. If there be a cavity in the

underlying bone, a depressed adherent cicatrix, it can be filled in with fat before the flap is sutured in place. A pad of fat, not too small and not too large, is removed from the buttocks and sewn into the cavity with catgut sutures. The flap is now placed over it. I have found this method satisfactory. Generally, some slight suppuration ensues when fat is used, but the final result is good. It may in some cases be better to remedy the faulty position of the lid first, and then subsequently to introduce the fat.

The same method is used to remedy a defect of the lid substance. A strip of skin adherent to the conjunctiva is retained, and is pushed up or down into its correct position by a flap of suitable size.

It will be noted that the upward flap can be made to contain a strip of eyebrow, which will eventually lie vertically. This strip can be utilised to replace the natural eyelashes, and with care and patience a good illusion may be obtained. The vertical brow-bearing layer is turned through 90 degrees in such manner that it comes to lie along the lid edge. I am able to show you a discharged soldier upon whom I have employed this method with unexpected success. You will notice that at a distance the illusion is perfect. This case was my first and most successful effort in eyelash replacement. The same result can be obtained at any part of the upper lid by splitting an appropriate part of the eyebrow and turning half of it as a flap into a vertical position. Later on, it is again turned on its lower end until it lies along the lid edge.

The flap method is equally successful at the inner aspect of the eye. Small flaps from the forehead cut along the natural wrinkles can be turned down to correct deformities or replace loss of substance in the neighbourhood of the inner canthus. I am showing you a man in whom I have completely closed in a large defect made by the radical excision of a rodent ulcer, using small flaps of this nature. Several operations were required to complete the cure, and even now there is some ectropion of the

lower lid. The rodent ulcer had been treated by radium and had healed superficially. I was suspicious, opened it up, and found extensive growth under the skin which involved the frontal sinus and the ethmoid cells. I opened up the frontal sinus and withdrew the whole lining membrane entire like the finger of a glove. I then thoroughly scraped out the ethmoid cells. A large skin defect remained, about the size of a shilling. This I have filled up by small flaps from the forehead. A Hess operation has failed to cure the ptosis which was caused by the tumour.

Great difficulty may be experienced when the frontal sinus or the maxillary antrum have been injured by the destructive energy of the projectile. I now show you a photograph of a case of this nature. My first operation was only a partial success. The conjunctiva was firmly attached to the scar, and could not be detached without injury. The rent was with difficulty sutured, and much trouble was experienced in keeping in place the fat which was necessary to fill a cavity in the bone. Eventually it suppurated and the improvement was only partial. Mr. Sydenham performed a Caldwell Luc radical antrum operation, and I have now successfully replaced the lid by a flap cut as described above. The moral is that such cases must first be treated by the rhinologist, and then a plastic operation will have a better chance of success.

I have indicated the broad lines of treatment, but each individual case calls for special methods. It is necessary carefully to think out a plan of action, and so conduct each stage of the attack that it forms a stepping-stone to the next. Pedunculated flaps heal with great rapidity, and in three or four weeks the original flap can be wholly or in part used to form a flap for a subsequent stage. For example, if, as in the case of the patient whose photograph I now show you, the inner canthus is displaced downwards and towards the nose, a flap can be placed horizontally under the lid, and a month later turned vertically to lie between the nose and the eye. When

this man first came to the Birmingham Eye Hospital "he looked," to quote the words of an old song, "as though a regiment had marched across his face." Now, after eight months of treatment, involving seven or eight operations, he can wear an artificial eye and is comparatively handsome. The last operation was to replace his eyebrow, the outer half of which was bent downwards at right angles to its correct position. Unfortunately, I put it a little too high, but he is perfectly satisfied.

Plastic surgery of the eyelids is a most fascinating pursuit, and I know of no branch of surgery which affords greater gratification both to the surgeon and to the patient.

Major A. W. Ormond:

He would like to ask one thing, because an answer to it would much help those who had these plastic operations to perform. It appeared to him that there were three types of occasion on which operative interference was called for in the way of plastic surgery. The first was at the very early stages, *i. e.* almost as soon as the patient was wounded, in which a slight stitching together, or a pulling together of the edges of the lids—especially the upper and lower lids, would greatly facilitate the subsequent condition. The second, whether those who received these cases a week or more after they had been wounded and had to look after them for weeks subsequently, could help towards the later treatment by Major Gillies, and how could they plan and carry out operations with the view of assisting the success of the final attempts at plastic surgery. He was sure that in an enormous number of the cases received from France it would be of great assistance to healing if the edges of the wound were more carefully drawn together with a stitch, and kept more or less in that condition before the man was passed on to the train, on which dressings were often displaced and the tissue with them, with the result that there was increased

difficulty in bringing the wounds into a good position subsequently. With regard to the Esser method, which Major Gillies mentioned, he had operated upon several of these cases, and would like to mention one small technical point, namely, that when making the wax model of the space it was desired to fill with epithelial tissue, it was difficult to hold the piece of wax. One held it with forceps, and when trying to cover the surface with a Thiersch graft, just before completing the process, it was liable to slip from the forceps. He had found that if, in modelling it, one arranged to leave a piece for holding it, by drawing out a piece as a handle, it obviated the liability to slip, and the piece so used could easily be snipped off afterwards with scissors. He had not been very pleased with the Esser method where he had tried it to form a new socket, *i. e.* where he had tried to form a new cavity, and get an artificial eye to fit it, the reason being that these cavities contracted. One obtained no area or space beyond, and the closing of the tissue round the artificial eye made it look somewhat unnatural. For carrying out the outlay method which Major Gillies described, the Esser method was much more valuable. It might be that he had not had the experience Major Gillies had, but he had not been very pleased with his attempts to make a new socket by the Esser method when the socket had been entirely destroyed. He suggested that glass globes were not likely to be very successful, although they were not technically inside the body ; there was no doubt that glass was a foreign substance, and would therefore be acted upon as such, being subject to attempts on the part of the tissues to push it out. That remark did not apply to cartilage, and it was extraordinary how cartilage when transplanted would live under most difficult circumstances. In cases in which he had transplanted cartilage he had had no failures, although in one or two instances the amount of suppuration had been considerable. If Major Gillies would give some indications or ideas to the meeting as to how those who were

looking after cases in the first two or three months after receiving their wounds could help him in his work; whether or not the surgeon should attempt to preserve all the orbital tissue as far as possible, or whether it was better to have models made for these men, *i. e.* whether it was a good thing to destroy small pieces of conjunctiva and cover in the whole of the orbit with skin and to have a model made, or whether every bit of conjunctiva should be conserved which would help the new socket.

Mr. M. S. Mayou

said he only wanted to refer to one point which was in connection with evisceration of the orbit. Usually, when evisceration was done, the flaps were allowed to fall back into the cavity, and the cavity was subsequently skin grafted, and it might occupy two or three months in the healing, leaving, at the end of that time, a deep hole. It was his practice—and he had done it ten times—to sew up the skin entirely. The skin was first dissected off the tarsal cartilage and reflected around the orbit. The periosteum was then incised and stripped up from the orbital walls and the contents evacuated in the ordinary way. The orbit was subsequently closed by sewing the skin tightly together over it. The wound in most of the cases united, but even in the cases where the stitches did not entirely hold healing was much facilitated. In one or two of his earlier cases he filled up the orbit with decalcified bone, but he now regarded that as unnecessary, as the blood-clot was sufficient. He showed a case six days after operation and photographs of the case of a boy who had orbital glioma ten days after the operation, with the wound completely healed; also a man, two years after.

Capt. R. R. Cruise

said that after hearing of Major Gillies' experiences and the extraordinary results he had achieved, he would like to ask him one or two questions. When the Major put in these outlays or inlays, what thickness of skin did he cover

the mould with? Was it an ordinary Thiersch graft shaving, or did he use the whole thickness of skin and subcutaneous tissue too? One knew about the shrinking which took place in these cases, and he would like to ask whether Major Gillies made allowance for this shrinking, or did he find that the shape he had arrived at as a result of his operation was the same eighteen months later? For there must be cases now which had remained as long as that under observation. It was the flaw he found in his own cases in which plastic operations had been carried out, that contraction went on and so in the course of months there was shrinkage, and final results were not as satisfactory as the immediate ones.

Mr. J. Gray Clegg

remarked that in civil practice the number of cases in which plastic operations on the lids were needed seemed to be limited. He did not think he operated on more than fifteen to twenty in the course of a year found in a large out-patient department. To-day, however, the profession was largely interested in how to treat in the best way the cases which resulted from the war. For ptosis he had often done Hess' operation with advantage. In one case he sutured the lid to the superior rectus, and, as far as the lid was concerned, it was all right, but the eye was pulled downwards. As the case was one of right-sided ptosis only, the result was not satisfactory. He had operated for restoration of the lower lid and for the upper lid in cases where the margin had been the seat of rodent ulcer, and there the Dieffenbach operation was satisfactory. For trichiasis he usually performed a van Millingen. Recently he had a case in which there was adhesion and marked symblepharon, the result of an old burn. In this case he used a Thiersch graft, after separating the lower lid from the globe. The man could see $\frac{6}{18}$ with that eye. In order to fix the Thiersch graft in position and get a good firm support, he put a Snellen

prothesis in the conjunctival sac in front of the eye for five or six days, and there was a very satisfactory result.

The President

said he thought Major Gillies' demonstration to-day had opened for ophthalmic surgeons a new era in regard to the methods of performing plastic operations on the eyelids, and before he asked that gentleman to reply, he would like the meeting to accord him a cordial vote of thanks for the excellent demonstration he had given.

The resolution was carried by acclamation.

Major Gillies,

in reply, said he felt overwhelmed by the kindness with which the Society had received him. He expected to find that many of the methods he had evolved, working by himself in the dark, would prove to be out of date, and if anything he had been able to do would be of use to these men who had lost their eyes, in giving them a last chance of wearing an artificial eye he felt repaid. His work had consisted in attempting ideal things, which, of course, he found impossible.

In answer to Major Ormond concerning early treatment, as others, notably Col. Lister, C.M.G., and Col. Newland, D.S.O., had had in France great experience of early treatment, he had little to say on that subject, except that he felt everything should be retained whose retention was at all possible; everything should be put back into its normal position at as early a date as possible, in the hope that some good might come of it. He suggested to Col. Lister and to Major Ormond that, in these early gunshot wounds, they might see cases where putting in a glass globe covered with a Thiersch graft into the socket might be of benefit as an immediate way of dealing with a wound, by excision of the wound and at the same time rendering the socket suitable for an artificial eye.

With regard to inlays, he agreed with Major Ormond as to the difficulty of covering the inlay with skin. It

was very liable to slip out, and he thought Major Ormond's suggestion was a very good one. He had done it, without knowing that he had, but he held the graft with a rat-tooth forceps, and he wrapped the skin graft round the rest of the mould with non-rat-tooth forceps so as to avoid tearing the graft. It was difficult to sew a skin graft round a Mules' globe.

With regard to the failure of inlays to take, he thought the greatest cause of failure for inlay and deepening sockets was the lack of putting in an apparatus immediately after removing the mould. There was the freshly united skin graft, which was in a delicate condition, and if it were not stretched out it would be obliterated. Mr. Clegg's idea of putting in a shell to hold the graft in position was a good one. That, he thought, was why epithelial inlays grew, and why the graft took so well.

Answering Capt. Cruise's question as to the thickness of skin used, that was connected with the same question as he had just touched on. One used a thin graft if it was to replace mucous membrane, a thick one if it was intended to replace skin. His practice had been to have gradually thicker ones. One case was cut thick inadvertently because the razor was bad, and it grew hairs on it; it was from the thigh. Recently he had put in a whole-thickness graft the size of a half-crown, not simply subcutaneous tissue, but whole skin, to replace a portion of nose, and it was kept in position mechanically. He thought that before very long there would be better methods of transplanting skin and ensuring their fixation. He did not think much shrinking had taken place in the cases he had had to deal with. The first one he showed was only six months old, but the movements acted as a constant prevention. He tried to overdo the relief of the lid to a certain extent.

With regard to the method of taking cartilage, at Col. Newland's suggestion they had modified it, and most of those working at Sidcup had accepted the suggestion. He had had the advantage of working with several of

those who had spoken; they were all working at the same subject. They got their cartilage by a vertical incision over the rectus muscle, exposing the costal margin. Much depended on what the cartilage was required for. If he required it for a shrunken socket, he had to take the whole thickness of the rib so as to ensure the needed diameter; if it was for putting round the margin of an eyelid, it was not necessary to break the continuity of the rib, and much pain was saved too. The operation was a very safe one. There had only been two cases of sepsis out of the seventy or eighty operations which had been done, and when that occurred it was always due to the deep sutures having gone wrong. It was necessary to avoid doing much bruising in getting out the cartilage. Cartilage was removed of a larger size than required, but must be accurately shaped before being applied. The surgeon removing the cartilage should not touch the face wound until the chest wound was closed up again in order to avoid contamination.

He was much obliged by the reception of his efforts.

IV. DISEASES OF THE CONJUNCTIVA.

1. *"Suture" operation for contracted socket and allied conditions.*

By Thomson Henderson.

Although a number of operations have been devised for the restoration of contracted sockets, it must be admitted few are even moderately successful. This is especially so in those cases in which the roof or, what is more important, the floor, of the socket slopes directly back from the lid margin to the apex of the cavity, and the sulcus, essential to hold the artificial eye, is conspicuous by its absence.

I have attempted most of the various procedures recommended, and because failure was more frequent than success, I have for long avoided operative interference in this type of case if I could do so.

Lately, however, I have devised and practised a very simple procedure, which, on account of the new principles involved and the excellent results obtained, I venture to bring before the notice of this Society.

The procedure in the case of retraction of the inferior fornix is as follows: The whole depth of the lower lid is grasped with fixation forceps, and a suture with curved needles at both ends is introduced from within, brought out a full half-inch below the lid margin. At least, two such sutures are inserted and tied firmly over a piece of rubber tubing.

The resulting traction pulls the apex of the orbital cavity forward, and at the same time causes the floor to

sink into a sulcus which will retain an artificial globe in position.

At the time of operating the artificial eye is not left *in situ*, but merely inserted to note the size which will fit with ease. The sutures are removed at the end of a week, when the artificial eye, fitted at the time of operation, is put in—a procedure which, as the socket at that time is still apt to be somewhat sensitive, is facilitated by the instillation of a few drops of cocaine.

The glass eye is at first worn for a few hours, but at the end of the second week it can be worn all day. By that time it may be found that a somewhat larger glass eye can be worn. I suggest this is due to a contraction of the cicatricial bands which develop in the course of the sutures, producing a further deepening of the sulcus by drawing upon and stretching the tissues at the apex of the socket. In dealing with the upper lid the same procedure is followed, only that the sutures are brought out on the eyebrows.

I have, in the past two months, followed this procedure in three cases with most gratifying results, especially when it be noted that, in all three, previous operations for contracted socket had been performed.

I admit, of course, that none of my cases have passed the test of time, and therefore the new-formed attachments may give way and the condition relapse. Should this happen, no harm has been done to the socket, and the operation can always be done over again.

I feel, however, so confident that this procedure is based on sound principles that without waiting for a further series of cases or for a longer time to elapse for those that I have done, I venture to plead for its more extensive trial. One thing is certain—no harm can be done, and that is a great deal more than can be said for any other procedure hitherto adopted for contracted socket.

Stout bands in an otherwise good socket can be as troublesome to rectify as a contracted socket itself, but

they can be most effectively dealt with by the same procedure. One of the two curved needles of the suture is passed from within out, through the fornix close to one side of the base of the band and out on to the surface, and the other needle is similarly directed on the other side. The suture now being in position but not tightened, the band is next divided close to and parallel with the lid surface to a depth approaching the fornix. The suture is now tied, with the result that instead of the former ridge its site is now marked by a slight depression which—and this is the important factor—is covered by mucous membrane brought together and approximated by the tightened suture.

The difficulty of guaranteeing success in every case where bands are divided is due to the impossibility of ensuring that mucous membrane covers the base of the divided band. If this is not done, the band will develop again, the principle involved being the same as applied to the successful relief of symblepharon, or webbed fingers.

The base of the incision must be covered by mucous membrane, and this the suture is admirably adapted to ensure.

I have recently operated by this method on three cases of cicatricial bands of the socket, on all three of which I had previously operated and watched their relapse during their detention in hospital as cerebro-spinal meningitis carriers.

Time is likewise here wanted to prove the permanency of the result, but nevertheless I consider that the principles involved are fundamentally sound. It is common knowledge that while cicatricial bands in a socket, or even a contracted socket itself, need not interfere with the insertion of an artificial eye they do prevent its retention, when stretched and pulled taut by action of the orbital muscles, with the result that the artificial eye resting thereon is simply lifted up and levered out of the socket. The bands, from their nature and action, can be regarded

as aberrant attachments of the orbital muscles, and their division—tantamount to a tenotomy—though it may diminish, does not completely get rid of the traction which they transmit.

Now in the procedure which I have adopted the band is not merely lengthened by division, but any traction which it might transmit is now borne by the connections between the fornix and skin formed by the suture. These cicatricial attachments of the suture carry the traction below, instead of across, the level of the fornix, so that the artificial eye cannot be shot out of the socket by movements of the orbital muscles.

In conclusion, I submit that the difference between a contracted socket and bands in a socket is one of degree rather than of kind, and the suture operation in either condition acts in the same way ; it not only restores the lid sulcus, but at the same time—what is probably an equally important factor—it diverts into new and harmless channels the aberrant traction of the orbital muscles.

Mr. Gray Clegg said he supposed this matter would come up again in the set discussion to be held in the afternoon on "Plastic Operations of the Eyelids," and one's views would be more suitably expressed then. But with regard to contracted sockets in association with the lower sulcus, on two occasions he had performed the Maxwell operation, making a boat-shaped incision in the skin, and undermining that, except in the middle portion where it was attached, making a hole through into the conjunctival cavity, and passing the skin through. That was successful in both the cases. He would not say anything on other operations at the moment.

Mr. J. B. Story said he had tried many kinds of plastic operations for contracted sockets. Some had succeeded fairly well, but others had been unsuccessful. He had listened with great interest to Capt. Henderson's description of his operation, and for certain forms of contracted socket it would be a very satisfactory pro-

cedure. But it appeared to him that only very few cases could be cured by the operation suggested. In the usual case of contracted socket he (the speaker) had met with this operation would be of no use. One desired to put in an eye as large as a marble when the socket would hardly admit a pea. Putting sutures into the remnant of mucous membrane had no effect in such cases. He, too, had performed Maxwell's operation, and with fair success. What he had done, in the case of moderately contracted sockets, where the operation was possible, was to transplant mucous membrane instead of skin, and he had found it to be fairly successful. But he had to confess that he had no love for any of these operations.

Capt. STACK said he had had a great number of these sockets presented to him in Bristol. The first thing to think about in a case of contracted socket was whether the eye would look well enough for the soldier to keep it uncovered. It was not sufficient to get an artificial eye into a socket if it did not make him sufficiently good-looking when the eye was exposed without a covering; otherwise it was not worth while wasting time by operating. Seldom was it of use to operate when the socket was very much contracted. The cases which were eminently successful were those in which there were bands at one or more places; for these much could be done. In about half the cases could one get the men to wear an artificial eye. In operating on these cases he had usually employed a Thiersch graft, or taken some mucous membrane from inside the lip. One wished to secure as large a sulcus as possible. If there were a mass of connective tissue, he cut the mucous membrane over it and dissected out the connective tissue. Into the hole he put a Thiersch graft, a procedure which was more successful in the socket than in any other part of the body. Before putting on the Thiersch graft he put two catgut sutures from each eyelid into the skin, keeping them widely open, leaving them there until they cut through of their own accord in three or four days. In that way the socket was kept quiet, and

the man's pink patch was the only dressing. For two or three days he did nothing to it: he did not even wash it.

Dr. Burdon Cooper, speaking of the material suitable for covering the raw surface, said he had had good results from rabbits' conjunctiva, the rabbit having been killed just before the operation; also from the membrane lying immediately within the shell of the hen's egg.

Capt. Thomson Henderson said, in reply, that one naturally did not expect any single operative procedure to produce the impossible. It was essential that one should have some reasonable tissue to work upon. What he wished to assure anyone who would try the method he had described, was that he would be surprised how the tissues would give, and enable a sulcus to be made. In one of his cases, on which he was still working, the socket was contracted above and below, and he was having sutures put in both directions, and the case was shaping extraordinarily well. Many would be surprised at the way in which they could stretch the apex of the socket.

2. *Papilloma of the conjunctiva.*

By M. L. Hepburn.

Albert C—, æt. $8\frac{1}{2}$ years. This boy was shown at the Ophthalmological Society's Meeting in 1917, and the extent of the growth is illustrated by a drawing (Plate IV, fig. 1). The vision in the eye at this time was $\frac{6}{6}$. Diathermic cautery was advised as a method of treatment rather than any surgical interference, and on May 31st, 1917, he had the first application, under the care of Dr. E. P. Cumberbatch, of St. Bartholomew's Hospital. Between May 31st, 1917, and December 17th, 1917, there were six applications, lasting on each occasion slightly less than a minute. In December it was reported that a considerable mass of the growth had disappeared, and for the next two months

the boy did not receive any treatment at all. In February, 1918, he came under my care again at Moorfields, and then the growth was seen to have very much increased, involving the whole of the lower lid, and extending deeply into the skin of the cheek down to the level of the malar bone; the upper lid was also involved over the whole of its extent, and the growths on both lids approximated so closely that the palpebral aperture was obliterated.

Under the circumstances, I felt that surgical interference was the only possible form of treatment, in spite of the fact that the tumour had been pronounced innocent, and I, therefore, performed exenteration of the orbit.

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3. *Case of epibulbar sarcoma cured by removal and the application of radium.*

By E. Treacher Collins.

Annie W—, æt. 34 years, first noticed a small spot on her right eye in May, 1915; it increased in size and in August, 1916, was removed by Mr. Cresswell at Cardiff Infirmary. Three months later it began to return. In September, 1917, by Mr. Cresswell's advice, she came to Moorfields Hospital, the growth during the previous two months having enlarged considerably.

A pigmented, lobulated mass was found springing from the conjunctiva at the outer margin of the cornea, by a base which occupied about one-fourth of its circumference on the temporal side. From this base the new growth fungated out, overlapping, but apparently not invading, the outer part of the cornea. The cornea was clear, and in other respects the eye appeared to be quite healthy. V. = $\frac{6}{36}$ + 4 cy., 60° down and in $\frac{6}{9}$. Enlarged conjunctival blood-vessels passed into the growth on its outer side. In the sclerotic, at the lower and inner part of the ciliary region, was an area of light brown discoloration,

quite separate from the growth. There were no enlarged glands to be felt, and the patient had always enjoyed good health. She had a pigmented mole on her left leg.

There was no history of any malignant growths in her family.

She was seen by several members of the Moorfields Hospital staff, all of whom agreed that the growth was probably a sarcoma. Several of them recommended that a small piece should be removed for microscopical examination, and then, if the diagnosis of sarcoma was confirmed, that an exenteration of the orbit should be performed. My own advice was somewhat different; I recommended that the growth should be cut away as completely as possible, and that afterwards the patient should be sent to the Radium Institute and have radium applied to the site from which it had sprung. This was the course which was ultimately adopted.

On September 20th, 1917, after the instillation of cocaine, I removed as much of the growth as I could from the surface of the globe. She left the hospital four days later to attend at the Radium Institute. The following are the notes of the treatment she received there, kindly given to me by Capt. A. E. Hayward Pinch, the Medical Superintendent:

"She received treatment on three occasions. On September 26th a flat applicator containing 7 mgrm. was applied without screen for thirty minutes. This effected considerable improvement, but when she reported on October 10th there was still a nodule at the outer part of the corneal margin. The same applicator was used, and an exposure of fifty minutes' duration given without screen. On December 5th, she was again seen and all that remained was a minute nodule the size of a hemp-seed at the upper margin of the cornea. This was treated with a tiny spherical applicator containing 7 mgrm. of radium unscreened for forty-five minutes, and no further treatment has been necessary."

She attended at the hospital on February 28th this

year; I could then find no sign of any recurrence of the growth; there was still present the light brown discoloured area in the sclerotic down and in, it showed no sign of any thickening or of extension; indeed, it appeared rather fainter in colour and less pronounced. The vision in the eye unaided was $\frac{6}{6}$.

To-day, March 3rd, the eye is in precisely the same condition as it was on February 28th.

Microscopical examination of sections of the piece of the growth removed shows cells of varying shape containing different-sized nuclei. The preponderating variety are small spindle-shaped cells. Many of the irregularly-shaped ones are probably spindle-shaped cells cut transversely. There are, however, some polygonal cells with large nuclei of an endothelial type. The intercellular tissue is for the most part scanty in amount, but in places it is composed of dense bundles enclosing groups of cells. Numerous blood vessels course through the growth, the walls of most of which consist of little more than an endothelial lining.

Mr. Leslie Paton: Early last year I had occasion to see a case in which the contents of one orbit had to be exenterated for sarcoma. It had been done by the late Mr. Jessop two years previously. About a year afterwards similar sarcomatous growth appeared at the upper margin of the left eye, and Mr. Jessop had removed the growth, leaving the eye as it was the man's only eye. I saw the man shortly after Mr. Jessop's death last year, when there was a large epibulbar growth, evidently a local recurrence of the growth Mr. Jessop had removed. The man said he did not want to sacrifice his eye, and asked me to try to remove the growth and leave his eye. I told the man it was pretty hopeless, but that I would try. In removing the growth I had to go very nearly to the apex of the orbit and take away half his levator palpebræ superioris to get beyond the confines of the growth. At the time of the operation I put in and kept

there twenty-four hours a tube of radium, obtained from the Radium Institute. I did not feel at all hopeful about the ultimate result of the case. When, however, I saw the man three weeks ago there was no trace of recurrence of growth. He had three subsequent applications of radium, which was placed up the nose so as to get its influence as far back in the orbit as was possible. That was sixteen months ago, and though the first recurrence after removal took place in very few months, there was as yet no sign of return. It is impossible to say how far this result is attributable to the free removal of the growth and how far to the action of radium.

Mr. J. B. Story said it was very satisfactory to be able to remove a melanotic epibulbar sarcoma without there being any local recurrence. But, of course, that was not a guarantee of the life of the patient. Some years ago he had the case of a man who said he hurt his eye when in South Africa. When he arrived in Dublin he had a melanotic sarcoma covering half the cornea. He removed the growth, and cauterised the region of the sclerotic from which the growth sprang, at the corneo-scleral margin. The patient lived for some years afterwards; he did not remember how many. About two years afterwards the man complained of pains in the neck, and there was found to be a tumour in a neck gland; he could not now say whether on the same side as the eye tumour. He went to another hospital to have that tumour removed; he (the speaker) was not able to go to that operation, but it was done by a friend, Mr. Franks, now in South Africa. He told an assistant of Mr. Story's that the growth in the neck was a melanotic sarcoma. The man died within a short time after that operation from a tumour said to be in his liver. He had also seen other cases in which he had removed intraocular melanotic growths, and in which there was no recurrence in the eye, but subsequent inquiry showed that practically all died subsequently of visceral growths, which were probably of the same nature. So that, even when removal of such growths was not followed

by local recurrence, the outlook for the patient was not good.

The PRESIDENT said, in reply, he was much obliged to Mr. Story for his remarks. The patient's vision in that eye was $\frac{6}{6}$, therefore he did not feel inclined to advise her to have the eye excised.

V. REPORT OF THE COMMITTEE ON "THE CONDITIONS AFFECTING THE STANDARD OF VISION IN THE BRITISH ARMY."

A Communication from Messrs. Traquair and Paterson on the Same Subject.

Mr. McMullen read the report, as follows:

Report of Committee on Visual Requirements in the Army.

Up to the present war the British Expeditionary Force had to be prepared to go anywhere in the world and to be independent of glasses.

The question of wearing spectacles by men in the Army had not been taken into account, there had been no regulation in regard to "glasses making a man fit" with the following results:

(1) The standard of vision in the British Army has been low, lower than in the continental armies.

(2) Many men in the past have been refused for their sight who would have made useful soldiers if they had been allowed to wear glasses.

(3) Those enlisted have not been made as efficient as they might have been.

In the continental armies, where glasses are allowed, the standard of acuity of vision required was $\frac{6}{12}$ with or without glasses, as opposed to $\frac{6}{24}$ unaided in the British Army.

Now that the British Army, as the result of the war, has had to be greatly increased, men who require glasses have had to be enlisted, and glasses are being issued to those who need them. The visual standard for General

Service (Class A) adopted early this year, in which visual acuity with glasses is taken into consideration for the first time, is as follows:

"(*a*) If a man's vision is $\frac{6}{24}$ in one eye without glasses, and his right eye can be brought up to $\frac{6}{12}$ with glasses, he will be considered fit for category A.

"(*b*) If a man has lost one eye, or has completely lost the sight of one eye, he will not be considered fit for category A."

The general principles which should be taken into consideration in fixing standards of vision for enlistment into the Army are follows:

(1) That a man's unaided sight should be sufficient to enable him to find his way about in bright and dim lights, and be such as will prevent him being a danger to his fellows.

(2) That he should not suffer from any progressive disease of the eye or one likely to recur.

These two general principles apply to all branches of the service, combatant or non-combatant.

A recruit who is to be trained as a combatant should also have sufficient acuity of vision, aided, if necessary, by glasses, to see what he is firing at, and to observe landmarks.

The British Army insists upon the right eye being the good one for shooting, but continental armies make no such distinction. Some men whose right eyes are defective shoot well from the right shoulder, using the left eye for aiming, especially at long range when the backsight is raised; but at short range the face has to be pressed so close to the rifle stock that the cheek is actually bruised, and the left eye has to be turned so much to the left that a man wearing glasses is unable to see through them.

With regard to firing from the left shoulder, the following objections have been raised:

(*a*) Musketry instructors consider training such men to be more trouble than it is worth.

(*b*) It is difficult, or even impossible in "rapid firing" to get the necessary number of rounds per minute.

(*c*) Should the bolt slip when firing it is liable to injure the face.

(*d*) The ejected cartridge cases are liable to be discharged into the face.

[*Note.*—Some military authorities hold that a man, unless he is a sniper, need not see what he shoots at, only sufficient visual acuity being required, aided, if necessary, by glasses, to enable him to fire in the right direction. This he can do quite well without accurate aiming, and he can shoot from the right shoulder quite efficiently even if the right eye be blind (*cf.* Germans who shoot from the hip during an advance). If this view prevailed a complete revision of standards would be necessary.]

In the continental armies for combatant service a good average acuity of vision, with or without glasses, is insisted on, but vision without glasses is not taken into account (except in certain countries where a limit is fixed to the degree of myopia, or compound astigmatism is not allowed); so that if a man loses his glasses he may be left with sight so defective that he no longer complies with the first general principle. He may be unable to find his way about, and may become a positive danger to his friends.

In the British Army a satisfactory standard of vision without glasses was insisted on, but until recently the possibility of improving a man's vision with glasses was not officially recognised.

Neither of these standards would seem to be entirely satisfactory, and in fixing the standard of vision, visual acuity both without and with glasses should be taken into consideration, as in the formula recently adopted for general service in the British Army.

It should be further noted that no examination of the eyes which consists only of reading letters, or counting dots, at a stated distance can prove satisfactory in all

cases. Diseased conditions of the eye which are incompatible with efficient military service may escape detection when such tests are alone employed.

Many examples of this have come before members of this Committee during the last three years. Cases where men have passed a sight test with letters, and after being fully trained as combatants have been found incapable of service, so that they have had to be discharged.

The Committee make the following suggestions as to the standards of vision to be required, and methods of testing in the examination of recruits :

(1) That the standard of vision for a man who is to be trained to shoot with the rifle and serve in the field, *i. e.* for general service, should be at least $\frac{6}{24}$ with either right or left eye without glasses, and at least $\frac{6}{12}$ with the right eye, aided, if necessary, by glasses. The strength of the correcting lens in the case of sphericals should not exceed 8 D., of simple cylindricals 4 D., and of the highest meridian in combined spherocylindricals 8 D.

He must also have a good field of vision, as tested by hand movement, with each eye, and not be suffering from any progressive or recurrent disease of the eye.

(2) The standard of vision for a man who is to receive a military training which does not necessitate the use of the rifle (*e. g.* R.H.A., R.F.A., R.G.A., R.E., R.A.M.C. bearers, and drivers in the A.S.C.) should be the same except that it is immaterial which eye has the better vision.

(3) That the standard of vision for a man who is to be trained for garrison duty at home or abroad should be at least $\frac{6}{60}$ with either right or left eye without glasses, and at least $\frac{6}{18}$ with the right eye, aided, if necessary, by glasses. The strength of the correcting lens in the case of sphericals should not exceed 10 D., of simple

cylindricals 6 D., and of the highest meridian in combined sphero-cylindricals 10 D.

He must also have a good field of vision, as tested by hand movement, with each eye, and not be suffering from any progressive or recurrent disease of the eye.

(4) That the standard of vision for a man who is not to receive a military training, but be employed only in auxiliary services, should be at least $\frac{6}{60}$ with one eye, either right or left, with or without glasses. The strength of the correcting lens in the case of sphericals should not exceed 15 D., of simple cylindricals 6 D., and of the highest meridian in combined sphero-cylindricals 15 D.

He must also have a full field of vision, as tested by hand movement, with one eye, and not be suffering from any progressive or recurrent disease of the eye. The other eye may be missing or totally blind.

It is probably, under present conditions, quite impracticable for every recruit to have his sight tested by a competent ophthalmologist. It is, however, most desirable to obtain uniformity of results, and to eliminate as far as possible any sense of unfairness in the matter of sight-testing. To accomplish this we would suggest that in the examination of recruits the first test should be carried out by a member of a Recruiting Medical Board with Snellen's test types, well illuminated, at six metres. He should be instructed to pass as fit for general service all those who can see without glasses $\frac{6}{24}$ with either the right or left eye, and with glasses $\frac{6}{12}$ with the right eye, and who have a good field of vision, as tested by hand movement, with each eye.

All those who fail to come up to this standard, or who

do so only with the aid of very strong glasses, or who complain of symptoms suggestive of recurrent or progressive eye disease, are to be referred for examination by an ophthalmologist.

The ophthalmologist should be required to report on those referred to him, stating what grades of service each is fitted for in accordance with the standards already given.

There should also be a Board including some senior ophthalmologist to be consulted in doubtful and difficult cases.

If the above provisional formula be taken as the standard of vision for entrance into the Army of a man who is to be trained as a combatant, it is obvious that amongst those enlisted there will be very various degrees of central acuity of vision. Some will prefer to fix with the right eye and some with the left. Some will be colour-blind. Some will and some will not have binocular vision. There will be varying degrees of defect in muscle balance and in the powers of accommodation. Even if those who may be termed "night blind" are excluded, there will still remain some whose capacity for dark adaptation is abnormally slow, whilst there will be others whose normal capacity under conditions of dark adaptation is above the average. There will also be very varying degrees of rapidity in the appreciation of visual stimuli.

Amongst both combatants and non-combatants in an army there are different forms of occupation in which the presence or absence of one or other of these different forms of visual capacity would render a man either eminently suitable or unsuitable. To obtain the maximum degree of efficiency in an army it would seem desirable first to determine what particular form of vision is most suited for any particular occupation, and then to devise as simple a means as possible for the selection of men to be trained for that occupation who possess that particular qualification. For example, it would be well if definite evidence could be obtained on points such as the following :

Are the best snipers those who have particularly acute central vision and who naturally fix with the right eye?

To what extent are good acuity of vision, binocular vision, good muscle balance, and full range of accommodation essential to a flying-man in judging distances in flying, fighting, or landing, and in observing?

Is defective colour-vision likely to cause trouble in some occupations under modern conditions of warfare?

Could a test for rapidity of appreciation of visual stimuli enable a selection to be made of those best suited for special training, *e. g.* as signallers?

To what extent are good visual acuity and good binocular vision essential for an artillery officer?

To arrive at any satisfactory conclusions on these and other personal matters, which would be of real practical value, the Committee consider that consultation between military experts and ophthalmic specialists is desirable; also that facilities would have to be afforded for the latter to collect evidence and carry out certain investigations. With these objects in view they drew up and sent the following letter to the Secretary of State for War:

August 4th, 1917.

Sir,—At the Annual Congress of the Ophthalmological Society of the United Kingdom, held in May last, the subject of the visual requirements for military purposes was discussed. The opinion was very generally expressed that the present standards of vision and system of sight-testing were not entirely satisfactory. It was therefore decided to appoint a committee to consider the matter.

The members of this Committee feel that it is impossible for them to arrive at conclusions which will be of any practical value unless they can obtain information as to the work of the different branches of the Army.

Their object in approaching the War Office is to ascertain how best this information can be obtained, and whether the War Office will be willing to grant the necessary facilities.

It may be mentioned that in 1907 the Ophthalmological

Society was consulted by the War Office as to the standard of vision that should be required of candidates for the Royal Military Academy, and it is suggested that possibly the services of this Committee might be of some assistance at the present time.

To this letter the following reply was received:

August 17th, 1917.

Sir,—I am commanded by the Army Council to acknowledge the receipt of your letter of the 4th inst., and, in reply, to inform you that the visual requirements of the various branches of the Army are dependent, in the first place, upon the conditions appertaining to the respective arms of the service and are determined by the Military Authorities. The translation of these requirements into optical language is then effected by the Military Medical Authorities. If there is any change proposed in the standard, the Council will be glad to avail themselves of the advice of the Ophthalmological Society of the United Kingdom, and I am to express the thanks of the Army Council to your Society for their kind offer of assistance.

I am, Sir,

Your obedient servant,

B. B. Cubitt.

With this reply before them, the Committee are obliged to report that they are not able to obtain the necessary evidence on the many important and interesting matters connected with the visual requirements of the Army which require investigation—an investigation which, in its opinion, would tend not only to increase the efficiency of the Army, but also be likely to save much needless expenditure of time and material.

E. Treacher Collins.
Richard R. Cruise (Capt. R.A.M.C.).
W. T. Lister (Temp. Col. A.M.S.).
George Mackay.
W. H. McMullen.
Arthur W. Ormond (Major R.A.M.C.).
J. Herbert Parsons (Col. A.M.S.).
W. T. Holmes Spicer.

Addendum by Major A. W. Ormond.

It is only right to point out that the letter represents the only communication made to the War Office, the report having been drawn up subsequently.

ARTHUR W. ORMOND.

Mr. MAYOU read the following communication on the same subject which had been received from Messrs. Traquair and Paterson:

11, MELVILLE STREET,
EDINBURGH.

DEAR MR. MAYOU,—

We have to thank you for your courteous letter of December 17th, 1917.

In the present circumstances it will be impossible for either of us to attend the meeting of the Ophthalmological Society at which the report of the Committee on the visual standards desirable in the British Army will come up for discussion.

May we take this opportunity of sending you some comments on the report as it appears in the *British Journal of Ophthalmology*?

(1) "The standard of vision in the British Army has been low, lower than in the continental armies."

This statement, made without qualification, appears to us very apt to mislead both the general reader and the military authorities.

It conveys the impression that in the recruitment of the British Army the standard of vision required was lower than on the Continent, while, of course, exactly the reverse was the case. This is virtually admitted in (2): "Many men in the past have been refused for their sight who would have made useful soldiers if they had been allowed to wear glasses."

These recruits would have been accepted as a matter of course in continental armies.

We think that it might with advantage be clearly stated in the report that a visual standard of $\frac{6}{24}$ with each eye without glasses is much higher in most respects than one of $\frac{6}{12}$ with glasses if required.

With regard to the standards advocated for the testing of recruits we would make the following comments:

(1) The standard required for general service, namely: "$\frac{6}{24}$ with either right or left eye without glasses and at least $\frac{6}{12}$ with the right eye aided, if necessary, by glasses" seems to us faulty. This standard, if strictly adhered to, is bound to exclude many cases of low myopia and myopic astigmatism. Myopia as low as 2 D. in each eye is likely to cause rejection, for it has to be remembered that an army conscript under examination is not inclined to make any special effort. As, in the great majority of myopes, the myopia is approximately the same in the two eyes the allowance of so strong a lens as 8 D. can only bring in a very limited number of additional recruits, some of whom, owing to their anisometropia, will be unable to make efficient use of the corrected right eye.

(3) The standard for garrison duty, namely: "$\frac{6}{60}$ with either right or left eye without glasses, and at least $\frac{6}{18}$ with the right eye, aided, if necessary, by glasses," seems to us to be too high. It will exclude most myopes with as little as 4 D., or even less, in each eye. Can it be maintained that a young man, physically sound, with good vision in each eye with -4 D. lenses is unfit even for garrison duty because his unaided vision is less than $\frac{6}{60}$?

In any continental army such men are freely accepted for general service. Here, also, the concession regarding lenses is largely illusory, as most myopias are fairly symmetrical and the recruits would be excluded at once by the distant vision test.

(4) *Auxiliary services.*—In this grade alone the principle of neglecting the result of the distant vision test without glasses has been accepted. This being the case, the standard of $\frac{6}{60}$ after correction in one eye would require very great discrimination in its application. For instance,

a man with one eye blind, say from retinal detachment, and $\frac{6}{60}$ with — 15 D. in the other would pass the test!

In this connection we are pleased to notice the Committee's opinion that recruits who fail to pass the standard for general service should be referred for examination by an ophthalmologist, and we hope that the Society will strongly urge the authorities to accept this recommendation.

We beg to submit the following modifications in the proposed standards:

(1) As a general principle the unaided vision should be regarded as of secondary importance provided that the refractive error is not too high and that the corrected vision is adequate for the various grades.

(2) If, however, the military authorities remain determined to adhere to the view that uncorrected vision is of primary importance we think that they should be urged to accept the substitution of $\frac{6}{60}$ for $\frac{6}{24}$ in the standard for general service.

(3) For garrison duty defective uncorrected vision should not be taken into consideration provided that it is capable of adequate improvement by glasses.

A dioptric limit might be adopted if considered necessary. It should not be lower than 10 D.

As neither of us expect to be able to take part in the discussion we would be greatly obliged if our letter could be laid before the meeting.

We remain,

Yours faithfully,

JAMES V. PATERSON.

H. M. TRAQUAIR.

Mr. G. HARTRIDGE said it must be necessary to separate the Flying Service men from the remainder of the Army in regard to the minimum standards of vision. That was now a very important arm of the services, and the nature of the work in the air needed a special standard of vision. He did not think the standard now proposed

was suitable for flying men. Since the communication from the War Office, there had been a good deal of evidence to go upon. Sir John Tweedy and himself drew up a standard of vision which they agreed was a good one for candidates for the Air Service, but that was at the beginning of the war, and the admission standard had now been lowered in accordance with the altered needs. In the earlier days there was a long waiting-list of candidates, but now it was said the standard set up resulted in the rejection of too many men. Even when it had been reduced, the standard remained higher than that for the other services. A man with deficient sight might easily make a bad landing, and besides imperilling his own life, might cause the death of his observer, and destroy his machine.

Mr. Ernest Clarke agreed that this subject was too large to discuss now, especially as it had an intimate association with the nervous and other physical conditions of the individual.

Mr. Harrison Butler asked whether the Government had adopted a standard of vision for the Air Service. If so, what was it ?

Mr. Hartridge replied that the standard for the Air Service was now $\frac{6}{12}$ with the good eye, capable of correction to $\frac{6}{6}$, and $\frac{6}{18}$ in the other eye, capable of correction to $\frac{6}{12}$. The standard for pilots and observers was now the same, though previously it differed.

VI. CONGENITAL ABNORMALITIES.

1. *A case of cryptophthalmos.*

By Walter Sinclair.

For the opportunity of showing this exceptionally complete example of one of the rarest malformations I am indebted to the kindness of Dr. E. Hollis of Woodbridge, in whose practice it occurred.

The patient is a healthy boy, æt. 21 months. On the right side the skin passes unbroken from forehead to cheek, showing no trace of eyebrows, eyelashes, or palpebral fissure. Over the eyeball, which can be felt to move with every movement of its fellow, the skin is vascular and red. It varies in colour from a rosy pink when the child is at rest to a bright brick red after exposure to cold wind, etc. Examination with the binocular magnifier shows that the reddened skin is smooth and hairless, while both above and below the red area there is fine papillary roughening and delicate hairs can be distinguished. When first seen eight months ago there was a small shallow dimple in the skin at the extreme outer angle of the orbital margin. This dimple is now much less evident.

The left eye and its adnexa are normal, and the child presents no other malformation of any kind.

The parents are healthy country folk with no ocular abnormality other than refractive error. They are first cousins. The patient is the first and only child, a previous pregnancy having ended in a miscarriage after a trap accident.

Cryptophthalmos appears to be exceedingly rare. Parsons (*Pathology of the Eye*, vol. iii, p. 779) gives a

list of eight cases published. Dr. Coover, of Denver, described and figured two bilateral cases in a mother and her child in the *Ophthalmoscope,* vol. xviii, p. 259. Col. R. H. Elliott has recorded a unilateral case in the *Indian Medical Gazette* of December, 1904, and there refers to a bilateral case published by Capt. Newman in the same

FIG. 30.

Cryptophthalmos.

journal (March, 1904). Dr. Thos. Snowball, of Burnley, informs me he has seen one unilateral case. So far as I have been able to ascertain fourteen human cases have been put on record. The condition is also met with in birds. One of van Duyse's cases, mentioned by Parsons, was in a pigeon, and Treacher Collins has described an instance occurring in a chick (*Lancet,* 1900).

At least seven of the cases have been examined anatomically and a *resumé* of the findings is given by Parsons (*loc. cit.*). The eye is invariably disorganised. The present case shows the abnormality in a more complete degree than most of those hitherto recorded. There has usually been some indication of a palpebral fissure, and eyebrows have been present in the majority. Eyelashes are invariably absent. Ocular muscles are developed, and in some of the cases a bright light concentrated over the eyeball area has caused wrinkling of the skin, suggesting the presence of perception of light and also of an orbicularis muscle. Bilateral cases exceed unilateral in the proportion of three to two.

Mr. M. S. Mayou showed some slides illustrative of the development of the lids; they showed why the conjunctiva developed into skin without eyelashes in cryptophthalmos. The eyelids are developed through grooves surmounted by a fold appearing above and below the cornea, and grow rapidly forward after contact with the globe, and just before union takes place are thrown into a number of horizontal folds at the margin. The lid margin then becomes firmly united by an epithelial bond, and from these folds processes grow down into the lid to form hair follicles and Meibomian glands. It is obvious in cryptophthalmos, therefore, if the lids do not develop these folds do not take place, and so there are no eyelashes present. The eyelids are united with each other till about the sixth month of fœtal life. The epithelium which lines the inner surface of the lids and conjunctiva remains as a single layer until separation of the lids takes place, when thickening in the conjunctival epithelium occurs. This is found to be so not only in the human fœtus, but also in animals this law holds good. In cats, in whom the eyelids are not separated until after birth, the epithelium was found to consist of a single layer as long as the eyelids were closed. In snakes, whose cornea covers the permanent membrana nictitans, the

inner conjunctival sac is lined with a single layer of epithelium throughout life.*

Further, in support of this theory is the fact that in cases of notches of the eyelid in which the apposition of the lids have been defective during fœtal life, dermoid patches are often found upon the conjunctiva.

Mr. SNOWBALL said he did once see a case of this kind, and it also was unilateral. There was no evidence whatever of a dip in the skin; the skin came continuously right from the eyebrow down to the cheek. The bulging of the eyeball was not so marked in the case he observed as in Mr. Sinclair's.

Lieut.-Col. ELLIOT said he handed to Mr. Sinclair a reprint from the *Indian Medical Gazette* containing a picture of the child that gentleman had mentioned. In that case the movement of the eyeball was distinct, though not so distinct as in the present child. In his own case the mother insisted on something being done. There was no conjunctival sac whatever; there was much loose connective tissue, and it would have been better to have left it alone, but for the mother's anxiety to have surgical interference. In the present case there seemed to be a more fully formed eyeball and better movement.

The PRESIDENT said he had recorded one case of cryptophthalmos† in a chick, and the family history of that chick was interesting. The mother of the chick was the daughter of the cock which was the father of the chick, and this cock also had other progeny with abnormalities. It had one chick which was born with two beaks, one which was born without a beak, and another which had four legs. The chick was sent to him because it would not peck. When he removed its feathers he found skin all over the front of the eyes. Microscopical sections of the eyes showed the uveal tract was well developed. The cornea was much thickened, the anterior part was composed of loose connective tissue, and the posterior part

* Mayou, *Hunterian Lectures*, 1905.

† *Vide Lancet*, February 17th, 1900.

had fibrous layers like the normal cornea. It projected backwards and there was no anterior chamber; the lens was rather small.

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2. *Congenital anterior synechiæ with buphthalmos and pupillary membrane.*

By M. S. Mayou.

F. G—, male, æt. 5 years. Came to the Bolingbroke Hospital. No family history of congenital defects. The condition of the eyes has been the same since birth. There was no discharge from the conjunctiva at birth. Healthy child. Cornea enlarged.

Decemet's membrane shows several ruptures. In both eyes there are several large strands of pupillary membrane, some of which pass right across from one side of the iris to the other. In the left eye the pupil is eccentric, and the iris is adherent to the cornea downwards and inwards; there was no superficial corneal opacity. The right disc is cupped, and the left shows a large scleral ring. T. + 1 in both eyes. On October 13th, 1917, left eye was trephined, and October 19th, 1917, right eye was trephined. The sclera was found to be extremely thin. The patient made an uninterrupted recovery. The right eye leaked fairly well, but in the left the tension seems still to be full.

VII. DISEASES OF THE CORNEA.

1. *Bilateral superficial symmetrical opacities of the cornea of unknown origin.*

By D. V. Giri.

On November 21st, 1917, Mrs. T. B—, æt. 54 years, came to the Eastbourne Eye Infirmary as an out-patient because of difficulty in near work in spite of glasses she had bought of some optician for the purpose. R.V.: $\frac{5}{9}$, not improvable, $\bar{c}$ + 2·5 sph. J_6. L.V.: $\frac{5}{9}$ (?) $\bar{c}$ + 1 sph. $\frac{5}{6}$ $\bar{c}$ + 3·5 sph. J_1. Pupils = active.

The corneal opacities are superficial, smooth, and situated about the horizontal meridian. The opacity on the right cornea is more extensive than the one on the left, fan-shaped, and feathery, being more rarified in the middle where the nasal half of the opacity forms an obtuse angle with the central half. That on the left cornea is dumb-bell shaped, uniformly diffuse, and does not reach the limbus, of which it stops short by about 2 mm. At the limbus where it is reached by the right opacity and the left is nearest to it, there are white crescents of what looks like calcareous deposit or degeneration of the cornea. There are no pinguiculæ.

There is no history of eye trouble in childhood. When she was about 15 she knocked her right eyebrow, which contused the lids, but did not affect the eyes. On one or two occasions while chopping wood the eyes were struck by flying pieces, but there was no impairment of vision and no trouble beyond transient smarting. She was unaware of the presence of opacities until about eight years ago, when her attention was called to it fortuitously.

Remarks.—From the history of the case the corneal opacities cannot well be ascribed to trauma, kerato-conjunctival inflammation, or ulceration. The condition is obviously different from the rare disease known as nodular opacity of the cornea, or what Haab described as Alphabet Keratitis; neither is it identifiable with Zonular Opacity of the cornea, which occurs mostly in eyes which are already nearly or completely blind as the result of intra-ocular inflammation such as irido-cyclitis and glaucoma, and only extremely seldom in otherwise healthy senile eyes, involves the lower half of the cornea, commencing at the two ends and ultimately meeting in the middle, and is broader at either end than in the middle, presenting a rough and rather dry surface, and can often be scraped off the surface of the cornea.

The interest of the case as an uncommon condition of the cornea aside, what has induced me to bring it to the notice of the Congress is to obtain suggestions from such members as have come across similar cases in their practice as regards effective treatment. For over five months she has used Ung. hydrarg. oxid. flav. 2 per cent., c̄ dionin 5 per cent., twice a day with no appreciable objective change in the opacities. The right opacity already covers two-thirds of the undilated pupil in average daylight, and the condition appears to be progressive, however slow.

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2. *Corneal degeneration.*

By M. S. Mayou.

(With Plate I, fig. 2.)

R. S. M—, male, æt. 47 years. History of his eyes, according to his own account, have been the same ever since he has been born. He thinks his vision has not been quite so good lately. He has six brothers and one sister with nothing wrong with their eyes. The father had some-

PLATE I.

Fig. 1 illustrates Mr. M. S. Mayou's paper on Purulent Ring Infiltration of the Cornea following "Mustard Gas" (p. 149).

Fig. 2 illustrates Mr. M. S. Mayou's paper on Corneal Degeneration (p. 148).

Fig. 3 illustrates Mr. E. Treacher Collins' paper on Bilateral Multiple Angiomata of the Retina (p. 165).

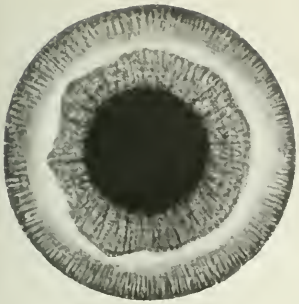

Fig. 1.

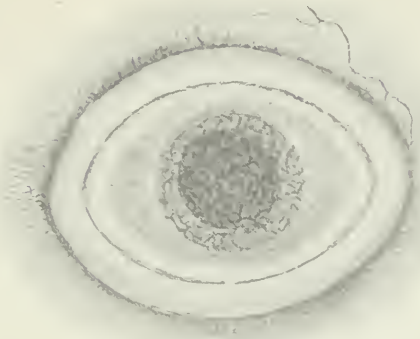

Fig. 2.

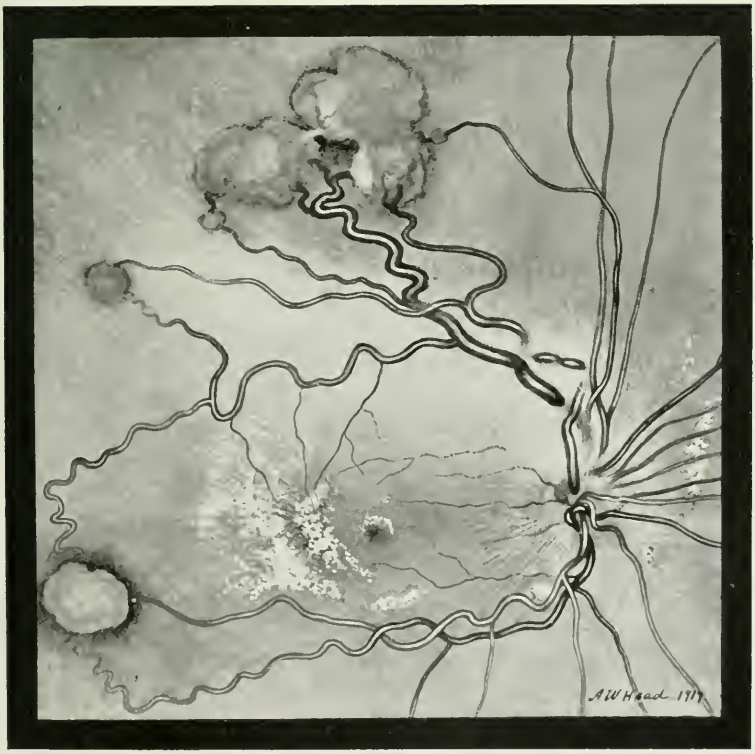

Fig. 3.

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thing the matter with his eyes, of which he does not know the nature. Photographs of his father, which have been examined, do not show any obvious change in the cornea.

Both eyes are prominent, and he is liable to attacks of conjunctivitis. The change in the cornea is essentially of the macula and nodular type in the interstitial substance of the cornea. It is densest around the margin where there are changes which look almost calcareous in character in it. About 2 mm. inside the corneal margin there is a brown ring of pigment. Inside this area the opacities get less dense and the details are better seen. (See Pl. I, fig. 2.) The change is similar in both eyes. Vision in right $\frac{6}{6}$ partly, left $\frac{6}{9}$ with -1 cyl. and axis horizontal. This vision is extaordinary, considering the density of the opacities. To show also that his vision is good he was second for the Amateur Championship of Snooker Pool.

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3. *Purulent ring infiltration of the cornea following "mustard gas."*

By M. S. Mayou.

(With Plate I, fig. 1.)

Soldier, æt. 33 years. Six days before being seen the patient was in the trenches when a gas shell exploded on the parapet. He was blinded at the time, and was sent almost directly over to England. Six days after the explosion there was intense injection of the conjunctiva and photophobia in both eyes. The lesion in the cornea was the same on both sides. The surface epithelium was slightly roughened but intact over the whole of both cornae. In the superficial layers of the cornea, about 2 mm. from the margin, was a yellow band of purulent infiltration. The margin towards the centre of the cornea was sharply defined and the cornea clear beyond it, but the outer margin was ill-defined and shaded

off into the surrounding cornea, which was practically clear at its margin. The patient has now been in the hospital for five weeks. The purulent exudation is absorbing without the surface epithelium breaking down, and all that now remains to be seen is a fine white line beneath the epithelium of the cornea which is also disappearing. The photophobia and blepharospasm is still very marked.

Remarks.—The lesions met with in mustard gas affecting the eyes are, staining of the skin of the lids, marked photophobia and blepharospasm, which lasts for a very considerable time. Palpebral and conjunctival ocular congestion. In a few cases the corneal epithelium near the limbus is roughened, but this is the only case in which I have met with purulent infiltration of the substantia propia.

Mr. Ernest Clarke said that the cases of "gas conjunctivitis" seen here were not the acute cases as seen in France; in fact, although he had treated a large number of cases, he had never failed to cure them in a short time with a mild antiseptic lotion and an occasional painting of the inside of the lids with 25 per cent. argyrol.

Capt. R. R. Cruise said the result of treatment in these cases had been rather unequal in his hands, though in the most satisfactory variety it had been extraordinarily successful. It was a drug members were familiar with, the only condition being that it must be used carefully. He referred to dionine. It produced remarkable results in blepharospasm and photophobia. His plan was to put in a drop of cocaine first and mop up the lacrymal secretion with a moist sponge, then apply two drops of dionine. A chemosis must follow, and the more of that there was the better. Patients complained of a sensation of burning half an hour afterwards, but in certain cases the relief was very pronounced. He did not know whether the difference in the results depended on the stage at which

it was used; in some cases it made little difference, while others were well in twenty-four hours. He had to-day come up from Wandsworth, where there were three patients who could not open their eyes on Wednesday, but to-day they were walking about. He had been using it since last November.

Major DERBY said he thought it was difficult to be dogmatic about the duration of these cases. He would say that one-third of the cases lasted a week, another third lasted two weeks, one-fifth of them lasted a month, and the small remainder up to, perhaps, two months.

VIII. DISEASES OF THE UVEAL TRACT.

1. *Herpes zoster affecting the ciliary nerves.*

By G. W. Thompson.

At the Clinical Meeting of this Society last year, Mr. Mayou showed two cases of herpes zoster ophthalmicus affecting the ciliary nerves, and now I wish to bring forward four cases bearing on this subject.

First Case.

September 4th, 1914.—Mr. I—, æt. 41 years, had a severe attack of left herpes zoster ophthalmicus affecting most of the branches of the first division of the fifth nerve, including the nasal branch. The patient said it came on the day after his nose had been forcibly washed out by a throat specialist.

When seen by me, ten days afterwards, he had a group of broken-down vesicles on the left side of the tip of the nose, and in the angle between the root of the nose and the supra-orbital ridge, with anæsthesia, well marked, on the left side of the nose. There was a circum-corneal injection, and two small superficial erosions on the upper part of the cornea. Typical keratitis punctata was also present.

Three days later, keratitis striata was observed for the first time. The keratitis punctata was unchanged.

A week later the circum-corneal injection was still present, but the corneal erosions did not stain. The keratitis striata had disappeared, and the keratitis punctata was now pigmented and very obvious about the centre of the cornea.

A fortnight later, a large, raised, highly vascular boss, not tender, was seen at the upper inner quadrant of the sclera, in contact with the corneo-scleral margin. This resembled a patch of episcleritis, and I regarded it as such, but from the cases I have subsequently seen I believe it to have been a herpetic manifestation of a branch of a ciliary nerve on its outward course through the sclerotic. The corneal erosions had healed, and the keratitis punctata was only a few spots. The bulbar conjunctiva elsewhere was not injected.

A month later, a faint keratitis punctata was still present. The episclerotic nodule was less pronounced.

A month later, only one or two spots of keratitis punctata were present. The episcleral nodule had subsided, leaving in its place a congested patch, with some discoloration in its centre.

A month later, this had all disappeared leaving a slightly discoloured spot.

Three years later there was no swelling, but still a slight discoloration at the site of the nodule. There was a specific history dating fifteen years back, and the Wassermann was distinctly positive.

Second Case.

September 14th, 1917.—Miss W—, æt. 36 years, came to me with the following history: Two months previously she had had a severe attack of herpes zoster on the right side, extending to the top of the head, with complications involving the eye three days later. There was also a history of throat trouble preceding the attack, attributed to influenza.

When first seen by me, the right side of the forehead was covered by numerous large, pigmented, scarred areas, typical of herpes. The cornea presented several small, dense opacities, obviously the scars of an herpetic eruption. The sensibility of the cornea was somewhat diminished.

There were two swellings on the sclerotic, well defined,

subconjunctival, raised, rounded, about the size of a large split pea, reddish in colour, with a dark (pigmented) spot in the somewhat translucent centre, the overlying conjunctiva being slightly injected. The rest of the bulbar conjunctiva was unaffected. The swelling at 5 o'clock was the smaller and situated a long way from the cornea the one at 8 was larger and nearer the cornea. These swellings I attributed to herpetic eruption in relation to a ciliary nerve in its course through the sclerotic.

When seen one month later, the 5 o'clock patch had all but disappeared, but the one at 8, though smaller, was marked by pigment in the centre.

Third Case.

February 8th, 1917.—Mr. C—, æt. 66 years, had an attack of severe herpes of the right side with no history of influenza. Fourteen days after the onset of the attack, he had cutaneous red patches in relation to the branches of the first division of the fifth nerve, including the nasal branch. The skin and cornea were painful and tender to the touch. No staining of cornea, but in its lower half it was cloudy from keratitis striata and slight keratitis punctata. The iris was injected. There were three well-defined and isolated subconjunctival reddish swellings on the sclerotic, somewhat away from the corneo-scleral junction, the upper one being considerably swollen and bossy, and resembling a patch of episcleritis. The bulbar conjunctiva elsewhere was not affected. These swellings resembled very closely those of the previous cases, and I regarded them as due to herpetic inflammatory affection in relation to a ciliary nerve.

A fortnight later the keratitis striata had cleared up. The keratitis punctata was slight but still present. Of the three sclerotic patches the one at 5 o'clock was more swollen, and resembled a low red cone with a limpid vesicular-like centre.

The further history of this case is interesting because, in spite of treatment, general and local, both the corneal

and scleral affection hung fire until two months later, when there was a sudden recrudescence of the keratitis striata and punctata, iritic adhesions formed, and the episcleral nodules became more pronounced.

I then sent the patient to be examined by a nose specialist, who found that both middle turbinal bodies were enlarged and pressing against the septum. These were treated with electric cautery and much reduced.

A month later the cornea was quite clear; the scleral patches had disappeared, the only reminder of their recent presence was a dusty or slate-coloured spot on the sclerotic.

Eight months later I asked the patient to come and see me, *i.e.* a week ago, and I found that the eyes were perfect except for some slight discoloration on the sclerotic.

Fourth Case.

January, 1917.—Miss P—, æt. 57 years, complained of intense neuralgia down the left side of the nose and forehead, the pain radiating behind the left ear and back of neck. She had a rash, that is, many small red areas were present on the left frontal region, spreading to the hairy scalp. There was œdema of the left upper lid, near the inner canthus, and a large patch of bulbar conjunctival injection on the nasal side of the cornea. The cornea was clear. The iris was dilated (mydriatic). I regarded it as an early case of herpes zoster. My opinion was confirmed, because a week later she developed an eruption of vesicles along the branches of the first division of the fifth nerve, including the nasal branch.

I did not see her until five months later, during which time she had been treated by her own doctor. The cornea then presented three opacities (healed vesicles), and there were two small, raised, rounded, reddish patches with discoloured centres on the sclerotic to the nasal side, and not far from the corneal margin. These I regarded as efflorescences of a herpetic nature on the course of a ciliary nerve.

Seen recently (ten months later): There was only a slight discoloration of the sclerotic near the cornea.

Summary.

Herpetic eruptions on the sclerotic occur in the course of severe attacks of herpes zoster ophthalmicus affecting the branches of the first division of the fifth nerve, includits nasal branch. They are usually associated with severe changes in the cornea, that is: Herpetic vesicles, keratitis striata, keratitis punctata, and iritis.

The eruptions or efflorescences either take the form of small, sharply circumscribed reddish nodules, or larger ones, somewhat flat and bossy, not unlike a patch of episcleritis, with this peculiarity, that the centre of the nodule or boss is usually translucent, or even resembles a limpid vesicle.

The eruptions usually come on about a fortnight after the corneal disturbances have declared themselves. They tend to persist for one or two months longer than the corneal troubles. They, however, clear up completely without disintegration or ulceration, leaving no depression, but a slight, small, brown or slaty-blue discoloration of the sclerotic, with the overlying conjunctiva adherent.

It is important to discover the underlying cause, such as syphilis, influenza, nasal or dental trouble, and treat it. As soon as the acute kerato-iritic manifestations have subsided under local treatment, such as fomentations and atropine, irritative remedies, *i. e.* ung. flav. with dionine, should be used to help to clear up the sclerotic nodules.

Mr. George Thompson, answering a question, said he could not say whether the sensibility of the cornea had been entirely restored after the disease had cleared up; he had not had an opportunity of testing the matter properly.

Mr. Mayou remarked that as Mr. Thompson had referred to two cases of herpes zoster affecting the ciliary nerves which he exhibited last year, he would like to give the

meeting the subsequent history of them, as they were not well when the cases were shown.

In the first case the nodule was superficial and lying in the sclera near the limbus. There was an opacity in the cornea, opposite the nodule. In this case there was no irido-cyclitis. The subsequent history of the nodule was that the attacks went on for about two months, with redness and inflammation, relapsing from time to time. Eventually the inflammatory trouble cleared up, and left a well-marked opacity in the cornea.

In the second case the nodule was much more deeply situated, and there was distinct bulging and pigmentation of the sclera over the situation of the nodule, with irido-cyclitis and keratitis punctata. This patient had four relapses of very severe irido-cyclitis, and she still had, at the present time, keratitis punctata, although her vision was now very much better than formerly, and the eye was quiet, with the exception of the keratitis punctata.

Dr. G. Mackay said he would like to know what other evidence there was of herpes in Mr. Mayou's cases, and whether there was any associated presence of tubercle bacillus.

Mr. Mayou, replying to Dr. Mackay, said both his patients had very severe herpes on the forehead, and the eye nodules appeared a week or ten days after the original herpetic eruption. In one of the patients the nasal branch of the first division of the fifth nerve was affected—he could not now say which—but not in the other. Both the patients were old, and the association with the herpes was so close that he did not think there was any reason to suspect the presence of tubercle.

Col. Lister said members were very much interested in Mr. Thompson's paper, and the only criticism he would make was in regard to terminology. The author spoke of "Herpes zoster affecting the ciliary nerves." Now, the characteristic of herpes zoster is the occurrence of groups of vesicles, situated in an area corresponding with the distribution of a sensory nerve, which break down and

form ulcers, and which are slow to heal. He understood that the lesions which Mr. Thompson described did not break down, but were of the nature of deep infiltrations.

Mr. G. Thompson, in reply, said that in most cases the sensitiveness of the cornea was very much diminished in herpes zoster. He agreed with Col. Lister that the terminology he had employed for this paper was not quite correct. He supposed they were not ciliary nerves, but nerves which went to serve the sclerotic and the conjunctiva, giving to them their sensation, rather than nerves connected with the ciliary body itself. He agreed that, with this terminology, there was a danger of associating the condition with the ciliary body or muscle. When the condition occurred on the surface, he thought there should be a different nomenclature. The centre of the nodules in these cases was peculiar—they were inclined to be translucent and vesicular. They never broke down into ulcers; there was no disintegration. He wondered whether it was necessary for there to be breaking down in order to render his terminology correct.

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2. *Peripapillary swelling (?) angioma.*

By Stroud Hosford.

L. A—, female, æt. 38 years, single, came to hospital August 23rd, 1917, complaining that sight in right eye had been gradually failing for the last eight months. She had had a blow on right brow in May, 1917, but the sight had been failing before that occurred. She also complained of headache—worse in the right frontal region—and pain in the back of right eyeball, vomiting, and sleeplessness. R.V. $\frac{6}{60}$, not improved; L.V. $\frac{6}{5}$ and J. 1 at 30 cm. Lids, muscles, lacrymal apparatus, and extra-ocular tissues all normal. T.n. Right fundus: There is a gradual elevation of the whole of the tissues immediately surrounding the optic nerve, except for a small gap down

and outwards. The swelling shades off in the surrounding retina, but markedly overhangs the disc above and to the inner side, and the disc appears to be sunken in a circular cushion of grey, striated, œdematous tissue, at the bottom of which the central pit of the optic disc can be well seen and appears to be natural. The retinal vessels are all enlarged and do not pulsate. The temporal (right) veins, especially the ascending, are enormously and uniformly enlarged, and appear to be so until lost from view at the periphery. There are a few fine splash hæmorrhages close to the centre of the macula. Vitreous is normal; left fundus is normal.

Patient was admitted to hospital and had inunction of mercury and large doses of iodide of potash. Two "Wassermanns" gave a slightly positive reaction. Patient left the hospital October 28th, hæmorrhages having disappeared, but swelling about the disc still persistent. P. of L. only obtained.

November 15th, 1917: There are now several small hæmorrhages again to be seen close to disc and at the macula. Swelling about the same size but more striated, and between the disc and the macula on the swelling are several curly new vessels which dip into the disc and are to be seen overhanging the disc.

November 29th: The tortuous new vessels are much clearer and more defined, and, perhaps, are more numerous. Hæmorrhages are less. Macula striated and spotted; fine hæmorrhages. P. of L. Patient seen every fortnight, but nothing new observed. Pit of O.D. well seen; depth = 7 D. Patient had fairly constant pain in the eye until February 7th, 1918, when she had bleeding from the left nostril, following severe headache.

Right eye examined, and more congestion of the vessels found and more œdema of the retina, and certainly more hæmorrhages found than when seen before; tortuous new vessels not altered. No vitreous opacities.

February 14th: There has been no pain since patient's last visit. V. = P. of L. Right pupil 5 mm., left 2 mm.;

both react to light. Fundus in right eye is much the same except that the hæmorrhages have cleared up again and a few faint stains only remain. Vessels still much engorged on the temporal side of the disc.

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3. *Ring sarcoma of optic papilla* (*endothelial sarcoma*).

By Stroud Hosford.

Sister P—, æt. 45 years, of the Maris Convent, Peckham, came complaining in January, 1905, of inability to see as well as formerly with the right eye; has "had pains in back of right eye" for last six months, and also "inability to read small print as easily as a year ago." Pupils equal and active. T.N. Extra-ocular tissues normal in each orbit. *Nil* abnormal in fundi. Fields not taken.

R.V.: $\frac{6}{9} + 0{\cdot}5$ sph.; $\bar{c} - 0{\cdot}5$ cyl. /90° $\frac{6}{5}$.

L.V.: $\frac{6}{9} - 0{\cdot}5$ cyl.; 30° $\frac{6}{5}$. J. 1; $\bar{c} + 1$ D. sph. added to each eye.

Patient had used a +1 D. sph. for reading during the last two years. Patient is healthy, with no history of past disease or injury.

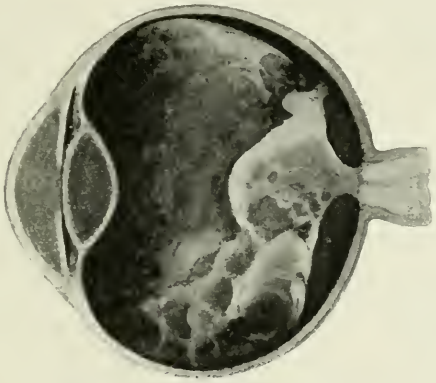
Patient returned five months later saying that pain in right eye was mostly after reading, but was absent if the eye was not used for near work. Vision $\frac{6}{9}$ easily with same lens. Field showed slight but definite enlargement of blind spot more in vertical axis, as taken with 2 mm. white disc at 30 cm. on a blackboard. Periphery of field normal, no scotomata. There was slight œdema all around the optic disc, but much more above and below than at the lateral margins. No exudate; no hæmorrhages; no vitreous opacities. Veins and arteries normal except for the ascending temporal vein, which was enlarged right out to the periphery as were its branches. T.N. Patient was given pill of Hg. and quinine.

In September the same year patient returned, and the papillœdema had extended a little more in all directions

around the disc, but was perhaps more marked above than below. The ascending temporal vein still very engorged. A.C. deep, pupils equal; T.n. R.V. $\frac{6}{18}$ with + 1·25 D. sph. Iodide and Hg. inunction administered.

Patient seen three months later, and pain had not been so frequent. Vision had deteriorated to $\frac{6}{24}$ with + 1·25 cyl. / 70° in. Swelling seen to be raised 2 D. above and 3 D. below the disc, more than at lateral parts. There was now a complete circular swelling surrounding the

Fig. 31.



Ring sarcoma of the optic papilla.

papilla, looking very much like a ring of œdematous, grey, jelly-like tissue. No detachment but a small, nearly central scotoma measuring 3 mm. at 30 cm. was found. No exudate or hæmorrhage or vitreous opacities; T.n.

Patient was then seen once a month, and nearly always complained of aching in the R.E. irrespective of use. In April, 1906, right pupil = 5, left = 3·5; T.n. No hæmorrhages, no exudate. Swelling encroached more on temporal side and above than heretofore. Pit of O.D. still visible and very deep, but surrounding retina showed cloudiness and striation for first time. V. $\frac{6}{60}$ + 1·75 cyl. ax. /70°. $\frac{6}{36}$, and two letters of $\frac{6}{24}$. Fine vitreous opacities. Excision was advised, but patient refused. In December, 1906, P.L.; pain, but no tenderness; T.n. Large,

irregular swelling to the outer side of the optic disc extending above the macula. No movable detachment of retina, which is still fixed to underlying growth, but it is spotted on the surface with blood in the region of the macula. In February, 1907, there was a sudden increase of pain, with lacrymation of the right eye; left eye also watered. There was now an irregular, raised mass, greyish and very striated, surrounding the disc, extending more above and below and to the temporal side right up to the periphery; the pit of the optic disc was faintly visible, but very deep and not clear in the centre. Veins much engorged, one branch thrombosed up and out at extreme periphery (?). Arteries slightly enlarged, streaks of splash-like hæmorrhage on swelling at the macula side, and several small spots of hæmorrhage were to be seen at the macula itself. General cloudiness of retina, with œdema and some grey spots of exudate. Vitreous faintly hazy, A.C. deep as usual. T.n. (?). V. = no P.L. (?). The vision slowly got worse, and in March the eye was certainly blind. In April, 1907, fundus could still be examined, but with difficulty, owing to the disorganisation of the vitreous. Pain constant, tumour well forward, much swelling of papilla. No external evidence of glaucoma or congestion of vessels of conjunctiva; cornea and lens clear. A.C. deep; T. (?). Patient returned in July, 1907, with pain. No glaucoma, cornea and lens clear and bright, but no red reflex could be obtained. Eye was excised July 17th, 1907.

There has been no recurrence. Patient is still alive and well in April, 1918, the vision in the left eye being $\frac{6}{5}$, with $-0{\cdot}5$ axis 30° cyl., J. 1, with $+2{\cdot}5$ D. sph. added. The pathologist's report stated that the tumour, which completely surrounds the optic nerve head, is an endothelioma, but at the extreme margins of the section are seen a few spindle and small round cells, which latter appear to infiltrate the neighbouring choroidal tissue far forward, where the choroid is not replaced by the growth.

Observations on the Case.

(1) The persistence of pain.

(2) The absence of tension and any evidence of glaucoma. The deep A.C.

(3) The absence of exudate and detached retina *per se*.

(4) The long-continued visibility of the central pit of the optic disc.

(5) The slow rate of visual deterioration.

(6) Lastly, the rarity of, and inexplicability of, the completely circular arrangement of the growth around the optic nerve head, from the earliest observations of the disease.

(A "Wassermann test" has since been performed and gives negative results.)

Mr. Brooksbank James said he could not agree that the first case Mr. Hosford referred to was a similar condition to the President's of angioma of the retina. The President's case was similar to one he had at Westminster some years ago. The condition occurred in the right eye, and at first he had never seen anything like it. But on referring to the literature he found the record of the President's case, also that which Mr. Wood, of Cape Town, described. Obviously it came into that category. He had seen Mr. Coats' paper dealing with the subject, which showed the incidence in regard to age, and other matters, but that was subsequent. Later the other eye was affected, and the patient, who was in Guy's Hospital, was seen by Mr. Eason, who wrote to him about the case and wished that they should publish it together. The war intervened, and they had not done so. He would have been interested to know the ultimate result. Probably the condition became the same as in the other eye and the sight was lost.

Mr. Hosford said that the reason why he had put a query before his diagnosis was because he had seen a case of endothelial sarcoma around the optic nerve head eleven years ago, the pathological specimen of which he now ex-

hibited. The clinical appearance in that case was almost exactly similar to the case of the patient shown this evening. That is to say, the swelling was entirely around the papilla and of an œdematous nature, with no exudate or effusion or other sign of inflammation beyond great enlargement of the vessels right out to the periphery of the fundus. The optic disc was natural in the centre, and the pit not filled in. The lamina cribrosa could be well seen; and the distance from the bottom of the cup to the top of the peripheral swelling was 7 to 9 dioptres. Both patients had marked pain in the eyeballs and orbit, but there was no rise in tension in either case. The case of the patient shown to-night differed from the President's and Mr. Coats' cases, in that the large vessels going to the periphery did not feed a patch of choroidal disease. When he showed the patient to the President a few weeks ago there were no signs of white spots in the macula, such as were depicted in the President's case, but since then a few very fine dots had appeared. He wished to thank the President for his opinion and suggestive criticism; the tortuous vessels on the peripapillary swelling and the recurrent bleeding from the nostril—although no nævi were to be found in the nostril—perhaps were in favour of an angioma, but he thought it better to wait for further signs or until the eye had been removed, before passing a final opinion.

IX. DISEASES OF THE RETINA AND OPTIC NERVE.

1. *Bilateral multiple angiomata of the retina.*

By E. Treacher Collins.

(With Plate I, fig. 3.)

Mary P—, came first to the Moorfields Hospital at the age of 20, in August, 1911. She complained of a film coming in front of her work as a machinist and of seeing large black dots in front of her. She was seen by one of my assistants who recorded her vision in the right eye as $\frac{6}{6}$ and in the left eye as $\frac{6}{9}$; there was no refractive error. He described the right fundus as showing a patch of colloid degeneration up and out from the disc, and the left vitreous as full of opacities with congested retinal veins.

She did not attend at the hospital again until November 8th, 1917. She had not experienced any further trouble with her eyes until the spring of that year, when the sight of the right for a time became misty. Six weeks previous to her second visit a very marked deterioration of sight in the right eye had taken place. On testing her I found she could only see $\frac{3}{60}$ with it, whilst with her left she still saw $\frac{6}{9}$. Ophthalmoscopic examination of the right showed enormous distension of the retinal blood-vessels, both arteries and veins, especially the superior and inferior temporal branches. These vessels were much convoluted, both laterally and antero-posteriorly; it was difficult to differentiate the arteries from the veins, the blood being much the same colour in them. On tracing the superior temporal vessels upwards to the periphery of the fundus they were seen to end by passing into two

raised masses in the retina of a pinkish hue, the retina around these masses being of a greyish colour. The dilated inferior temporal vessels terminated in a similar raised mass, which was not, however, so large as the upper ones. Besides these main masses there was another still smaller one, with large blood-vessels going to it, in the outer part of the periphery of the fundus. In the retina to the outer side of the macula, and also to a less extent to the inner side of the optic disc, were numerous bright, shining, white dots and patches, with here and there little flecks of pigment about them (Plate I, fig. 3). Changes of a similar description were found in her left eye, but not so extensive, the inferior temporal retinal vessels were the most dilated, and they ended, as in the right eye, in a raised pinkish mass.

The patient is one of a family of three, having had two brothers older than herself; one, æt. 31 years, is alive, and has never made any complaint of his eyes, the other, who was killed recently fighting, was "cross-eyed." There is no history of any eye disease in either her father or her mother.

The patient states that her general health is quite good; there is no history of any lung affection or of anything suggestive of tubercle.

The Wassermann reaction is negative.

Remarks.—I have called this case one of angiomata of the retina because, in a case presenting a similar ophthalmoscopic appearance of the retinal vessels, shown at this Society by Dr. D. J. Wood (vol. xii, p. 143), in which I subsequently had the opportunity of making a pathological examination of the fellow eye, I found that the enlarged vessels terminated in a new growth composed of a mass of capillary blood-vessels (vol. xiv, p. 141). I think there can be little doubt that the raised masses of pinkish hue, into which the big tortuous vessels pass in this case, are also composed of blood-vessels.

A number of cases of this description have now been published; they were collected and discussed by Coats in

a paper in the *Royal London Ophthalmic Hospital Reports* (vol. xvii, 1908, p. 496).

The special features of interest in the present case are: (1) That there are several separate new growths in the same retina. (2) That both eyes are affected. (3) That the growths are evidently progressive and increasing in size.

X. DISEASES AFFECTING THE CENTRAL NERVOUS SYSTEM ASSOCIATED WITH OCULAR CONDITIONS.

1. *Paralysis of ocular muscles.*

By James Taylor.

The cases shown by Dr. James Taylor comprised several in which a variable paralysis of ocular muscles was the chief feature. The paralysis usually affected chiefly branches of the third nerve, and in some instances was bilateral.

Myasthenia gravis.—One patient, a man, referred to Dr. Taylor by Mr. Worth, had defect in the upward, downward, and inward movement of the right eye. This cleared up completely and the patient remained well for a year. There has recently been a recurrence of the paralysis. There was no weakness of the limbs. Another, also a man, referred to Dr. Taylor by Mr. Hudson, had weakness of all muscles supplied by the branches of both thirds except the pupil. There was also associated weakness of the limbs. The paralysis was very variable, but did not clear up completely. Another patient, a young woman, referred to Dr. Taylor by Mr. Percy Flemming, had, five years ago, weakness of the muscles supplied by both third nerves—more marked on the right than on the left side. There was double ptosis and considerable general weakness. The paralysis cleared up, but has recently recurred after the lapse of four years, and is now well marked.

Dr. Taylor's view was that these cases are really examples of myasthenia, and if this view is correct it

would indicate that in some cases of myasthenia the weakness may affect *only* the ocular muscles. It is well recognised that in cases of myasthenia the ocular muscles are always affected, although weakness of limbs and other structures is also usually present.

Several cases of *Graves's disease* were also shown in which there was marked weakness of all ocular movements.

"*Botulism.*"—A case of some interest was shown, referred to Dr. Taylor by Mr. Fisher, that of a woman in whom there had been the sudden onset of great bodily weakness and of almost complete paralysis of all branches of both third nerves except those for the pupils. The patient was dull and lethargic, and in this respect resembles the cases of "epidemic stupor" described by Dr. Batten and Dr. Still as occurring in children. These cases are of interest with reference to the occurrence at the present time of cases of so-called "Botulism."

Dr. Taylor also showed a man referred to him by Mr. Percy Flemming—the member of a family in which several members are the victims of *Leber's atrophy.* This family was described in a paper published in the *Transactions* some years ago by Dr. Gordon Holmes and Dr. Taylor. At that time this patient—then æt. 47 years—was free from the disease. In September last—at the age of 51 years—he had sudden impairment of vision and now has well-marked central scotoma for colours. He is a very heavy smoker. It is of interest with special reference to the view recently propounded by Mr. Herbert Fisher, that an X-ray photograph of the pituitary region in this patient shows an enlargement of the pituitary fossa with an oblique position of the anterior clinoid process.

2. *Papillœdema and allied conditions.*

By Leslie Paton.

A series of five cases of papillœdema in cerebral tumour illustrating different features in the ophthalmoscopic pictures.

Case 1.—*Concentric foldings of the retina.*—The case illustrates particularly well the way in which the retina is occasionally wrinkled up into concentric folds by the swelling of the disc. In many cases these folds can only be seen as faint greyish lines concentric with the edge of the disc, but in this case there have been several hæmorrhages which have settled down in the hollows of the folds, and so brought them into prominence. In some cases the swelling fibres, instead of pushing the retina outwards, pass underneath it, and lift it up from the pigment epithelium.

Case 2.—*Development of macular form.*—A case of very intense papillœdema, in which the macular form had developed while the case was under observation. The œdema spread first as a greyish wedge-shaped area from the edge of the disc with its point at the macula. This gradually formed into the typical macular form of radiating white lines.

Case 3.—*Papillœdema with preservation of physiological pit and clear outer edge.*—In this case, though there is a considerable degree of swelling (+ 4 D.), it is confined to the inner, upper, and lower segments of the disc and the physiological pit, and the outer edge of the disc remains clear, and there is a very marked parallax between the swollen inner half and the physiological pit. In a paper on "The Pathology of Papillœdema," by Gordon Holmes and myself, sections of a similar case are shown.

Case 4.—*Papillœdema with large areas of swollen nerve-fibres.*—This case shows numerous soft opaque whitish areas on the crests and slopes of the swelling. Holmes

and I, in the paper already referred to, were able to show that many of these areas were due to the swelling up of nerve-fibres lying in œdematous areas. These swollen nerve-fibres ultimately develop into cytoid bodies. We were able to show that in albuminuric retinitis similar soft whitish areas in the course of nerve-fibres in other parts of the retina away from the disc were produced in the same way by the swelling up of nerve-fibres and the production of cytoid bodies.

Case 5.—*Papillœdema with rapid loss of sight.*—The swelling in this case very soon took on a curious opalescent tint, and the arteries became rapidly reduced in calibre. The visual prognosis in such cases where this opalescence appears early is extremely bad.

Allied Conditions.

To compare with these five cases of papillœdema in cerebral tumours I show two cases in which, with a true optic neuritis, there is, or was, acute swelling of the disc resembling ordinary tumour papillœdema.

Case 1.—*A case of disseminated myelitis.*—The characteristic feature in this case is that the blindness definitely preceded by a few days the onset of any obvious ophthalmoscopic changes. The swelling at its height was about + 3 D. It has already commenced to subside, and there is already some recovery of peripheral vision in the right eye, though the left eye still remains blind. The right pupil has recovered some power of reacting to light, but not the left.

Case 2.—*Acute disseminated sclerosis.*—This girl (under the care of Dr. Farquhar Buzzard) early in January of this year was in the National Hospital. She had then in the left disc a swelling of + 3 D., with very marked loss of visual acuity. The swelling subsided very rapidly with complete restoration of vision, but the disc remains very pale. Some years ago I read a paper before the Society in which I called attention to the occasional appearance of swelling in the optic discs simulating

papillœdema, but occurring in the true optic neuritis (so-called retrobulbar neuritis) of disseminated sclerosis, and I adverted to the fact that in most of these cases the presence of the swollen disc had given rise to a false diagnosis of tumour, and only autopsy had revealed the true diagnosis. The important differentiating features are: (1) That the loss of sight precedes the development of the swelling; (2) that the swelling lasts only a short time, often disappearing completely in two or three weeks; (3) that the recovery of vision may be complete even after complete temporary blindness. I have watched one such case pass through two attacks at an interval of six years, and, though in both attacks the vision in the affected eye fell to less than $\frac{6}{60}$, complete recovery followed, except for a slight paracentral scotoma for green.

I believe that the development of swelling in such cases is due to the fact that the optic nerve is attacked in the anterior part of its course after the entry of the central vessels, and that in the acute œdema which characterises the early stage of the development of a patch of disseminated sclerosis, the central vessels are compressed, and swelling of the disc results; but, as there is no blocking of the lymphatic drainage from the disc, the swelling is only of a transitory nature.

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3. *Two cases of "epidemic stupor" with ophthalmoplegia.*

By F. E. Batten.

The condition of which he had shown examples had been called "epidemic stupor." At the present time, in the Children's Hospital, there were about five cases of the condition, in whom the symptoms had come on acutely, giving rise to a stuporose condition, and in the two patients shown to-day there was the additional symptom of ophthalmoplegia, but that was not a necessary accompaniment in all cases of the disease. He would not now attempt to enter into details, but all the

examinations of the blood, cerebro-spinal fluid, urine, fæces, etc., they had so far been able to carry out, had been negative. Dr. Still had a case under his care of a child, æt. 3 months, which had been breast-fed only. One of the cases shown to-day, æt. 11 months, also had had only breast milk and bread-and-milk. He thought it was obvious that the condition was fairly widespread, for, in addition to the series of cases at the Children's Hospital, he had seen instances at other hospitals. There was gradual recovery, but none, so far (two months since the onset), could be considered complete. What relationship these cases bore to the so-called botulism cases was not for him to say, but the stupor inclined one to the view that they belonged to the same group. If so, these cases seemed to exclude the idea that they were due to food poisoning, neither had the cases the characteristics which pointed to food poisoning, one of which was that other members of the family would be affected; no other members in the families of these patients were similarly affected.

The PRESIDENT asked whether Dr. Taylor or Dr. Batten could say if cases of so-called botulism sometimes recovered, and if mild cases of the disease were sometimes met with?

Dr. TAYLOR replied that he had not much acquaintance with botulism, but he had read of cases having recovered.

Mr. LESLIE PATON said that in a series of cases recorded by Willbrand and Saenger the percentage of deaths in botulism was much lower than in cases with similar symptoms which ensued on acute alcoholism. In cases of acute polio-encephalitis following alcoholism practically every case died; and in those cases apparently, as far as investigations had gone, the changes were more acute, for there were in nearly all petechial hæmorrhages scattered through the grey matter of the floor of the third and fourth ventricles and the aqueduct of Sylvius. The cases shown to-day by Dr. Batten were extremely interesting,

because they brought into prominence one of the very characteristic features which was pointed out as a differentiation between acute superior polio-encephalitis cases and cases of, possibly, disseminated sclerosis or myasthenia, in the fact that in the former there was a pronounced somnolence. At the end of Wernicke's article occurred these words: "As we have earlier learned, the chief differentiating characteristic between the two diseases lies in the somnolence," and he laid stress on the fact to such an extent that Mauthner based his theory of physiological sleep on the fact that there was such a marked somnolence in these polio-encephalitis cases. He had the good fortune to see the development, from almost its earliest stages, of one of these cases in the present epidemic; he saw the lady in question twenty-four to forty-eight hours after the commencement of the symptoms, the reason of that being that she was already under treatment in a nursing home on account of a widely distributed skin affection. He was asked to see the case because it was thought to be one of drug poisoning. When he saw her, she had a dilated right pupil, with loss of accommodation on that side. The movements of the right eye were fairly good. There was no ptosis in the right eye then, but there was definite weakness of the left eye, with, perhaps, some weakness of the right internal rectus. At that stage there was no intellectual deficiency or sleepiness. But two days later she had become definitely somnolent, had double ptosis, complete and absolute ophthalmoplegia, external and internal, in the right eye. Of the left, there was only external rectus weakness. That was now four weeks ago, and he feared she was becoming steadily worse. Her temperature did not rise above 101° F.

He had since seen two other cases. One, in an American officer, was a comparatively mild case. He had definite somnolence; he was always asleep when Mr. Paton went to see him. Occasionally, however, he awakened somewhat, and then showed definite—almost purposive—movements and semi-delirium. He would sit up in bed

for five or ten minutes, and the nurse told him (the speaker) that he had been issuing commands ordering his battery about; in other words, he showed a condition very much like that seen in acute atropine poisoning, and the likeness of these cases to acute alkaloidal poisoning has already been remarked.

With regard to the other case he had seen, Dr. Kinnier Wilson would be able to tell the meeting more about that than he himself could. In that case the mental changes were very marked. In the American officer there was, every day or two, very definite evidence of delayed response, slurring of speech, and some weakness of palate. That was the case also in the other man, whose case was, in fact, more definitely mental. In the lady he had mentioned the mental change was practically *nil*, the only feature in that respect being that she was difficult to rouse from her somnolence. Everything seemed to point to the probability that there was some acute toxic condition, but whether the toxin was produced by bacterial action in the host was a doubtful point. He thought there was no doubt that in botulism the toxin was not produced in the organism of the patient. Von Erminghem found that the *B. botulinus* was a saprophyte, and the toxin was produced in sausage, or fish, or beans. In the bulk of the American cases a poison produced in canned vegetables was responsible. There was a big epidemic in California, and that was produced by beans and other vegetables which had been preserved in a cold pack and had not been heated for preservation. The case of Dr. Batten, he thought, upset the view that the cases now being seen were instances of botulism; all there seemed justification for saying about them was that they were polio-encephalitis due to an infection of unknown nature.

In saying the *B. botulinus* was a saprophyte he was quoting from one of the American journals, and in some of the American States there had been a large experience of the disease. The same was true of Germany. He did not think there was justification for speaking of these

present cases as botulism, but as instances of polio-encephalitis due to an infecting agent or to a toxin. The article of which he spoke, said of the *B. botulinus*: "This organism is a saprophyte, not multiplying in living tissue, even though it may cause" (etc., reads). That seemed to confirm the idea that these present cases were not botulism.

Dr. Kinnier Wilson said the exact nature of what went by the name of botulism was far from clear. Most neurologists had had recent experience of a type of case which was essentially of a toxi-infective nature, and in which ocular symptoms were predominant; but it was a long step from that condition to the genuine botulism. The important point to remember was, that there were two types of symptoms: General cerebral symptoms, and localising polio-encephalitic symptoms. Some of the cases might show cortical or general symptoms markedly, with very slight ophthalmoplegic symptoms, and in others the opposite might be true; and any stage between the one and the other might be met with. In that lay the importance of the cases which Dr. Batten had shown this morning, because in them stupor and drowsiness had been the most marked and prominent feature. Indeed, in one of Dr. Batten's cases there was no ophthalmoplegia at all. But one case he would quote was typical of this acute disease. It occurred in the North of London, the patient being a girl, æt. 18 years, in whom there was no history of food poisoning which he could trace. He saw her on the day after Good Friday. She had had a sudden onset of an acute illness, with paralysis of the left side of the body, and complete ophthalmoplegia externa. She was excessively drowsy and lay immobile with eyes shut. There was no increased temperature, nor evidence of meningitis. She died on the twelfth day of her illness, and he secured a *post-mortem* examination. There was found to be marked evidence of a toxic hæmmorrhagic condition in the mesencephalon. In her case, the symptoms were mainly those of ophthalmoplegia

and hemiplegia, but her mental condition was such that it was clear there was a general toxæmia. Neurologists might be interested to know that she presented a marked degree of Witzelsucht. The cerebro-spinal fluid was tested five times, and there was no trace of organisms, nor yet in the sections. Therefore, whatever it was, it could not be regarded as an infective so much as a toxic condition.

Col. PARSONS said he did not know whether members would like to see a child which was now in Moorfields Hospital. On Sunday it started an illness with diplopia and dizziness, which had increased; it also had increasing ptosis in both eyes. The mental condition was muddled, and the child had a temperature. The history which could be gleaned as to what the child had been eating was vague, as the mother was out at work all day. He had been looking up the literature of botulism. It must be remembered that this was not a new disease; it had been common in Germany, and presumably Germans recognised it as a definite entity. A good deal of literature had been got together on the subject, and, although there seemed to be a definite group of cases which had been labelled botulism, commencing with ophthalmoplegia, they were not satisfactorily distinguished from ptomaine poisoning. On the other hand, the ptomaine cases either died quickly, or got well quickly or fairly quickly. The records of cases of botulism did not, he thought, bear out Mr. Paton's remark that there was no further increase or development of the toxin within the host. Botulism seemed to be a much more serious disease, and a large proportion of the cases seemed to have died with evidences of increased toxæmia, as though the poison was elaborated in the patient's system. In the *post-mortem* examinations of cases of botulism recorded in German literature there were signs of the polioencephalitic type, with hæmorrhages in many parts. The wise course at present was the difficult one of suspending judgment on the cases.

Dr. James Taylor, in reply, said he would like to bring out one point. Because the poison in question was produced outside the body, there was no reason why this should not be the poison which was producing the symptoms in these cases now shown. He was not saying these were instances of botulism, but there was no proof positive that they were not.

4. *Case of sympathetic paralysis, associated with cervical rib.**

By M. S. Mayou.

Mr. Mayou said that in 1916 he showed this case. He was showing it again at this meeting at the National Hospital in order to obtain information, because he understood that cervical ribs did not, as a rule, give rise to sympathetic paralysis. This child had no other symptoms due to her cervical rib, such as wasting of the hand, but she had sympathetic paralysis. He exhibited the skiagram. He would like opinions as to what was the connection between the two conditions.

Dr. Kinnier Wilson said it was true that in the majority of cases of cervical rib sympathetic paralysis was absent, but it should be borne in mind that cervical rib was a developmental anomaly. A few cases had been described in which cervical rib had been associated with syringomyelia, and it was conceivable that in a small percentage of cases there might be a localised congenital defect in Budge's centre, in the eighth cervical and first dorsal segments, corresponding to, or in association with, the other developmental anomaly, viz., cervical rib. In this girl there might be a double developmental anomaly; he could not prove it, but it was a hypothesis to be considered. It was difficult to explain the absence

* *Trans. Oph. Soc.*, vol. xxxvi, p. 410.

of sympathetic palsy in such a large number of cervical rib cases if the cervical rib in this case were the explanation of the palsy.

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5. *Case of monocular traumatic altitudinal hemianopsia.*

By J. Gray Clegg.

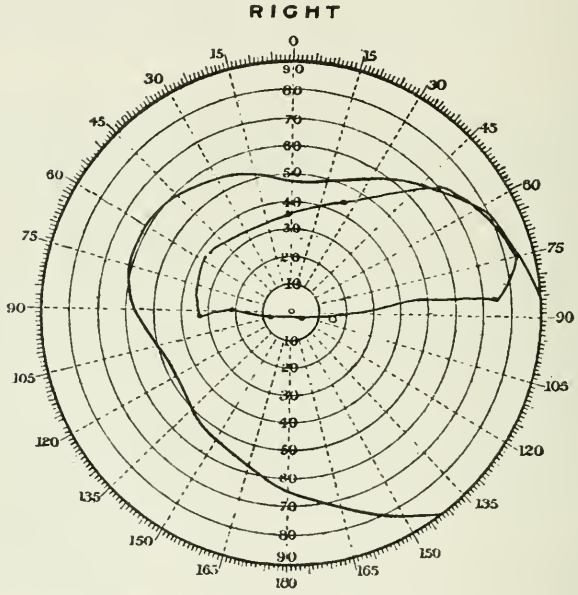
We have all met with cases in which comparatively slight blows on the skull have brought about rapid, or even sudden, blindness of one eye, and cases have been recorded in which both eyes have shown definite signs of optic atrophy following concussion of the cranium.

During the last twelve months I have had under my care a boy who fell and struck his forehead on the pavement. Complete blindness of the right eye resulted, and atrophy of the optic disc was noted some three weeks later. Sometimes medico-legal questions arise, and last autumn I had to do with a case of a man who was knocked down by a taxi-cab. At the time of my examination both optic discs were absolutely pale. As there were no knee-jerks present I have the gravest doubt as to whether the condition of his optic nerve was the result of the trauma, which certainly occurred, for the man was extensively cut about the face, and was treated for his injuries in the Accident Department of the Manchester Royal Infirmary. The Insurance Company was glad to settle the case for a few hundred pounds, although the claim for compensation was much weakened by the refusal of the man to allow either a Wassermann test or an examination of the cerebro-spinal fluid.

I have only once had an experience of a case, the full details of which I now give : A young married woman, M. G—, æt. 27 years, was passing through a doorway when the door blew to and fairly rapidly closed, striking her on the left side of her nose. A small bruise was

produced, but some dimness of vision in the right eye was noticed next day, and for this she consulted her own medical man one week later, who sent her to bed for a week. She was not rendered unconscious, but saw "stars." At the end of that period she was seen by me,

Fig. 32.



Mrs. M. G—, December 15th, 1910.

and I found a complete inferior altitudinal hemianopsia, and on examining the fundus I discovered a hæmorrhage adjacent to the optic disc, but lying above and somewhat to the outer side. It was about two-thirds the diameter of the disc.

Three weeks later I again saw the patient, and found the hæmorrhage to be rather smaller. It was then situated up and out from the disc, and about half its size, one border almost touching the disc margin. The lower retinal vein was much engorged, and it pulsated slightly where it pierced the optic disc; the vessels of the upper half were distinctly

smaller. The visual acuity on this date was finger-counting in the upper field.

The left eye possessed normal vision, and was healthy in every respect.

A year and a half later—that is, on March 14th, 1912—I found the visual acuity had improved to $\frac{6}{36}$ c̄ + 1 D. sph. = $\frac{6}{24}$, J. 10, the left eye giving normal acuity still.

On March 5th, 1914, the right eye gave V. = $\frac{5}{36}$ c̄ + 2 D. sph. = $\frac{5}{24}$, but I was able to get $\frac{5}{9}$ with the head bent low.

The left vision was: V. = $\frac{5}{4}$ fairly, c̄ + 2 D. sph., ⊂ +0·5 D. cyl. axis vertical = $\frac{5}{4}$ fairly, J. 1.

I did a retinoscopy on the right eye, and found the refraction to be merely + 2 D. sph. An inspection of the fundus showed that the superior retinal arteries were but one-third of the diameter of the lower. The disc was somewhat pale in the upper half, and rather indistinct at the margin, but no other fundus lesion was discoverable. The left fundus remained absolutely healthy. I again took the fields for white and red.

I saw the patient on March 7th of this year. The right visual acuity was $\frac{5}{9}$ c̄ + 1·5 D. sph. = $\frac{5}{9}$, J. 4, but with + 2 D. sph. = J. 1.

Left, $\frac{5}{5}$ partly, c̄ + 2 D. sph. = $\frac{5}{4}$, J. 1. The condition of the optic disc was as described in 1914.

In most of the cases damage to the optic nerve is due to fracture of the sphenoid passing through the optic foramen, but in this case the appearances rather point to a hæmorrhage into the nerve-sheath, which must have occurred quite near the entrance of the optic nerve into the globe, otherwise the whole arteria centralis retinæ would have been affected, and not simply the superior branches. Evidently the cribriform fascia was sufficiently resistant to prevent the blood appearing actually on the optic disc at the time of the accident, but some of it must have found its way just at the periphery of the nerve from the intervaginal sheath.

I should like to have the opinion of members as to the

exact cause of the damage, as it is not easy to conceive how such a hæmorrhage could occur from a comparatively slight blow on the nasal bone if it really only affected the immediate retro-bulbar part of the nerve. The possibility that the hæmorrhage really took place near the optic foramen and travelled along the vaginal sheath, and only produced such pressure on the branches of the central artery near the optic nerve entrance, can be conceived, and is supported by the fact that the visual defect was not observed till the following day.

I last saw the patient on April 29th, 1918, and took fields for white and green. The right palpebral fissure was then noted to be rather wider than the left, and the right pupil was a trifle larger than the left, but both reacted normally.

Mr. J. B. Story said he remembered fairly well a case of altitudinal hemianopia in a maiden lady æt. 50 or 60 years. She came to him because, she said, she had lost half the field of the left eye, and there was complete hemianopsia; she had lost either the top or the bottom half of the field. He was much surprised at that, as the eye looked normal ophthalmoscopically. She had an exactly similar defect in the field of the other eye, very little less in size than in the eye she had come to complain of. That was six years ago. He had seen her within the last year, and found the fields exactly as they were then. He felt himself unable to account for the lesion.

6. *Case of double homonymous lateral hemianopsia.*

By J. Gray Clegg.

Mrs. T. H—, æt. 71 years, seen on June 14th, 1911.

History.—Was taken ill on April 23rd, 1911. Sensation of weight on top of head and loss of sight. No clear

vision since. Had sunstroke eight years previously, which affected left side. Had not been able to see on left afterward, but could manage to read and sew with glasses till April last.

R.V. = $\frac{5}{18}$, $\bar{c}$ + 1 D. sph. = $\frac{5}{6}$, $\bar{c}$ + 6 D. sph. = J. 1 at 20 cm. L.V. = $\frac{5}{60}$, $\bar{c}$ + 1 D sph. = $\frac{5}{9}$, $\bar{c}$ + 6 D. sph. = J. 2 at 20 cm.

Orthophoria at 0·3 m.; no perception of red line at greater distance. Media clear, fundi normal. Fields confined to a radius of 7° to 10°.

The case proves the separate representation of the macula in the brain, if proof were needed.

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7. *A case of myotonia atrophica, with a family history of cataract.*

By Kinnier Wilson.

Dr. Kinnier Wilson said the case he was about to mention was a typical case of myotonia atrophica—a rare disease. The ophthalmological interest of the case was not so much in the individual shown as in the fact that in these families there was frequently a history of cataract. The father's father had double cataract. On investigation of a number of these cases, definite evidence had been obtained of different combinations, either myotonia occurring by itself, other members of the family having had cataract, or *vice versâ*; or a condition of cataract and myotonia in the individual himself, or alternating in different generations. He would not now enter into the difficult question as to why these combinations should occur. He was desirous that members of the Society should see a typical case of this condition, so that it might be recognised if, by any chance, cases appeared before ophthalmologists for the cataract part of the trouble. In most of the cases the cataract was an early condition, coming on at about thirty years of age, though in some of

the recorded cases it had appeared as late as the sixtieth year. Several of the members had expressed to him that morning their ignorance of the condition, not merely that they had not seen such cases, but that they had not known of the condition. In the *Transactions* of the Society for 1911 Mr. Ormond contributed a paper on it, and other papers had been published, and the literature of it was increasing.

Mr. Leslie Paton said he had seen a certain number of such cases, but only a few. He had seen a case of Dr. Batten's, which he had hoped would have been shown, in which the lens changes were evident. They were fairly deep, but not right at the back of the lens. They were irregular, and not like Coppock cataract, nor like glass-workers' cataract. Dr. Godwin Greenfield reported a series of cases some years ago, but in those cases, unfortunately, the cataract was not very carefully described. He (the speaker) saw those cases and made a careful note of the lens changes. The interest was as to whether there might be some relation between the toxin, whatever it might be, which had produced this myotonia and the lens changes. Much work had been done lately on the relationship between tetany and lamellar cataract. It might prove that just as the appearance of guaiudin in defective action of the parathyroids produced tetany and possibly was the cause of lamellar cataracts, so some similar substance due to a metabolic defect might be the common cause of myotonia and these curious cataracts.

On the motion of Mr. J. B. Story, the meeting passed a cordial vote of thanks to Dr. Kinnier Wilson for having organised such an instructive series of cases for inspection and discussion.

XI. PERIMETERS AND PERIMETRIC OBSERVATIONS.

1. *On a new form of scotometer, and on a sign elicited by its use.*

By R. H. Elliot.

As the alchemists sought for the fabled philosopher's stone, so have the students of ophthalmology striven to discover a sign or signs whereby they might with certainty diagnose the presence of glaucoma. The object of this paper is to bring to the attention of the profession a sign, which the writer has found of the greatest value in contributing towards the end so long and so eagerly sought. He does not wish to make any extravagant claim for it, for on no one piece of evidence should glaucoma be diagnosed, but he believes that it is of great practical value, and he desires that it should have the fullest test at the hands of the profession. Before describing the apparatus used, and the features of the new sign, it seems advisable to run shortly over the important work of Bjerrum, Roenne, and Seidel, which has led up to the present position.

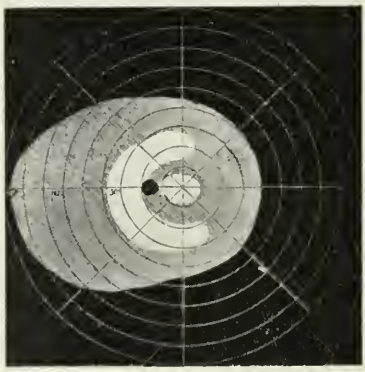
Bjerrum's sign.—Before the Tenth International Congress of Medicine, in 1890, Bjerrum described a defect in the visual field, which he had discovered by means of small-object perimetry, and which he regarded as strongly suggestive of the presence of glaucoma. This consisted of an arcuate or of an annular scotoma, which started from the blind spot and swept round either above the central area of fixation or below it, or both (Figs. 33 and 34). He laid special stress on the fact that the starting-

place of these curved defects was invariably the blind spot; from this and from their shape he asserted that

Fig. 33.

(Bjerrum.) Chronic glaucoma R.E. Fields for $\frac{1}{300}$ and $\frac{4}{2000}$. The latter field is divided into two parts - a central zone and a peripheral bow-shaped zone. Note that the blind spot is continuous with the relative defect both above and below, and also with the field for small objects. Part of the arched Bjerrum scotoma is absolute, and reaches out from the blind spot to the area of absolutely lost peripheral vision.

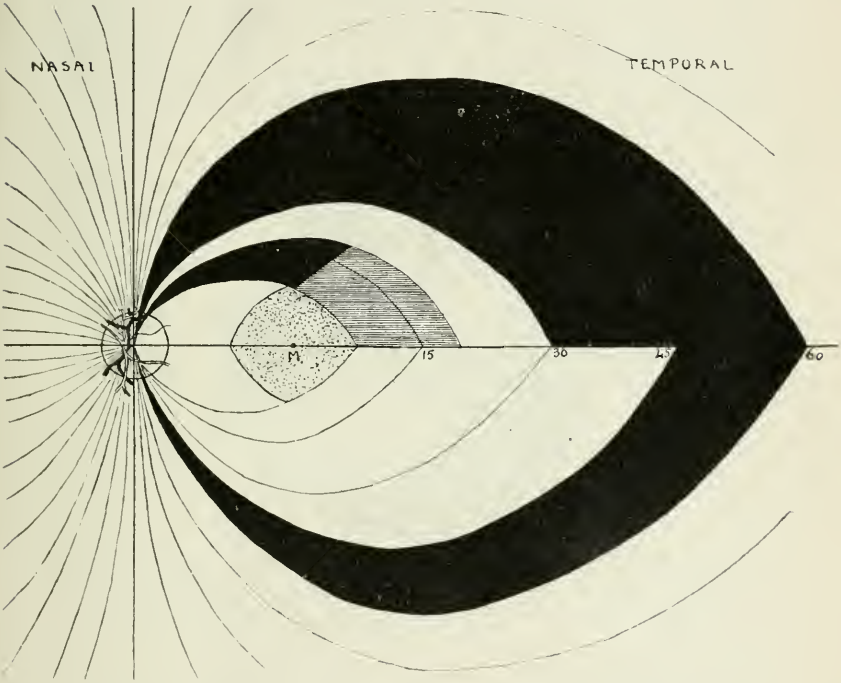
Fig. 34.



(Bjerrum, L.E.). A double arcuate scotoma surrounds the central visual area. The blind spot lies in contact with the relative scotomata, and with the two areas in which the small object can still be distinguished. The larger one of these by its horseshoe form indicates its connection with the distribution of bundles of nerve-fibres.

they must be due to the destruction of a limited bundle, or of limited bundles, of nerve fibres, the injury to which lay either at the margin of the papilla or in its near neighbourhood. The bundles in question emerged from

Fig. 35.



The diagram shows quite roughly the arrangement of the optic nerve-fibres as they spread out on the retina. The macular area (*M*) is dotted; absolute scotomata are black, and relative scotomata shaded. The defects in the nerve-bundles of the retina which would correspond with the visual defect, shown in Fig. 36, are illustrated.

the upper or from the lower margin of the papilla on its temporal side (Fig. 35). No other theory would explain the fact that the defects found correspond strictly with the distribution of such nerve bundles. Bjerrum argued that if the lesion were at the upper margin of the disc,

the curving scotoma would sweep round the lower border of the central area of vision; if it were at the lower margin, it would pass above it; whilst if it were dual in nature, an annular scotoma would result.

Roenne's step.—Roenne carried Bjerrum's work a little farther, when he argued that, assuming the correctness of the anatomical data put forward by the latter writer, the scotomata produced must show characteristic features at still another point, viz. in the horizontal meridian of the visual field to the nasal side of the centre of vision.

Fig. 36.

Chart from a R.E. with chronic glaucoma. Bjerrum's sign is well shown; so also is Roenne's step. The lesions to the bundles of optic nerve-fibres lie at the temporal edge of the disc, as shown in Fig. 35. Over the dotted area vision was indistinct.

This argument will be easily followed by anyone who has studied the anatomical distribution of the nerve-fibre bundles in the retina. Such a study explains the valuable sign known as Roenne's step, which is well illustrated by Fig. 36. On following the horizontal meridian from the blind spot toward the nasal margin, it will be observed that the limits of the field no longer correspond above and below that meridian. To take Fig. 36 as an example: Whereas the field above the nasal meridian extends out nearly to the 50° circle, that below it is much more extensively curtailed, stopping short of the 30° line;

the point on the horizontal meridian, at which in this instance the curtailment of the field begins below, is seen to be sharply marked out in a step-like manner.

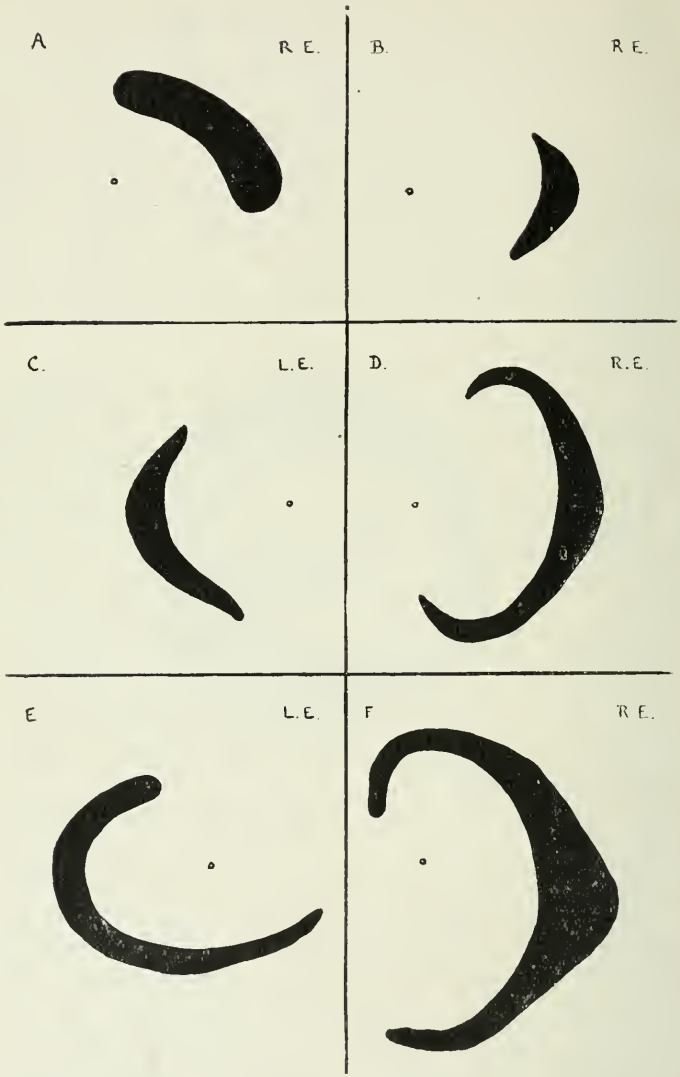
Bjerrum's sign is also very clearly shown on the same chart. The dotted area represents a relative scotoma, the vision having there been indistinct. This chart must be taken along with the diagram in Fig. 35, which shows roughly the defects in the nerve bundles of the retina, which would correspond with the visual field defects above depicted. It will be seen that the lesions to the bundles of optic nerve fibres lie at different parts of the temporal edge of the disc.

Seidel's sign.—We come next to the work that has been done on the same subject by another of Bjerrum's pupils, Seidel (von Graefe's *Archiv für Ophthalmologie*, Bd. lxxxviii, 1914, p. 102). This writer has found that very early in glaucoma a characteristic change can be found in the blind spot. This consists of wing-like extensions of that spot either upwards or downwards, or in both directions. The small scotomata so produced present a curved contour, whose concavity always faces the fixation point. They differ from those described by Bjerrum and his school in their size, being much smaller, and therefore easily overlooked. From the first they are continuous with the blind spot; their opposite extremities taper, sometimes even to a point.

Seidel claims that these scotomata may be found in the apparently perfectly healthy eyes of patients, whose opposite globes have already shown signs of glaucoma, and he believes that a diagnosis can sometimes be made in this way, at a time when there is no other sign pointing to even the faintest suspicion of the disease. A little later, when the scotomata are better marked, but before pathological cupping of the disc can be seen, he has found a pallor of the papilla, which he considers to be an evidence of the early advance of glaucoma.

Should the condition of increased intra-ocular pressure continue, Seidel's sign will pass on into Bjerrum's sign.

FIG. 37.



Seidel's paracentral scotomata, as mapped out by Sattler and himself, in early cases of glaucoma. The circular dot represents the fixation point of the visual field in each case. The side of the eye is indicated by the letters R.E. or L.E., as the case may be. In *A* the scotoma lies above the horizontal meridian; this

On the other hand, should it be relieved, a Bjerrum's scotoma may undergo retrogression, thus passing back into a Seidel's scotoma; and again, a Seidel's scotoma may greatly diminish in size, or may totally disappear, leaving the blind spot normal once more. From all this it is clear that these scotomata are merely a transition form in the development of the field defects described by Bjerrum. Fig. 37 shows some characteristic forms which Seidel's sign may take. These are from his original drawings. It should be especially noticed that he never figured them except as continuous with the blind spot from the first, whereas Bjerrum and others, who have followed in his footsteps, have depicted the characteristic Bjerrum's scotoma as sometimes making its first appearance at some little distance from the blind spot, and later becoming continuous with it. The resemblance in general configuration between the scotomata depicted by Seidel and by Bjerrum, is sufficiently striking to arrest the attention of anyone who studies the subject.

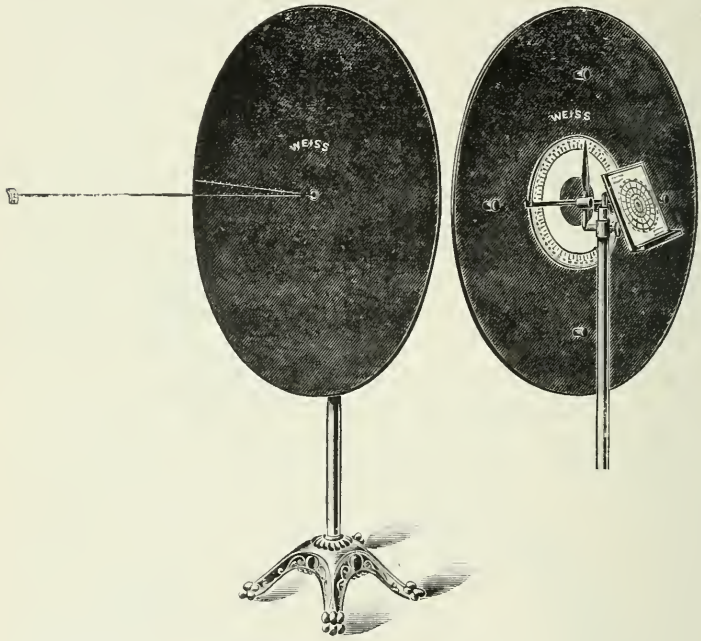
For a good many years past the writer has been endeavouring to measure, with some degree of accuracy, the normal blind spot, and that met with in glaucomatous subjects. The publication of Seidel's paper served as an added stimulus to this research, which was conducted largely with the aid of Bjerrum's screen. The results, however, failed to give full satisfaction, and it was this sense of failure which led to the introduction of the instrument which is the subject of the present paper (Fig. 38), and which represents an effort to combine the advantages of Priestley Smith's revolving scotometer with those of the Bjerrum screen. It consists of a circular disc, a little

is an uncommon finding. In *B* it lies mostly below it. In *C*, *D*, *E*, and *F* it stretches both above and below it. The later illustrations show progressively better marked and larger scotomata.

All the figures were taken with a 3 mm. object at a distance of 1 m. from the screen, and then photographed. They are only a few of the most typical ones of a large number published by Seidel (Graefe's *Archiv für Ophthalmologie*, vol. lxxxviii).

over one metre in diameter, covered with black cloth, and rotating on a central axis. At the centre is a small fixation object, and there is an arrangement to keep the patient at the correct distance of one metre from the screen. From the centre to the periphery along one

Fig. 38.—Author's Scotometer.



The front view is shown to the left, the back to the right. In the latter one of the charts is seen on the desk, for direct registration of the readings, if required. The author prefers to take the first readings on the form shown in Fig. 39, and subsequently to transfer these to a chart.

radius, or if preferred, across the whole diameter, the wheel is marked out by longer and shorter stitches of black silk into 5° and 1° spaces. The rotating objects consist of 1 or 2 mm. discs of white blotting-paper, which readily adhere to the cloth, and can easily be moved from one degree mark to another, as in Priestley Smith's scotometer. The arrangement for reading off the meri-

dian of observation is also borrowed from the same instrument; it consists of a cardboard disc fixed to the centre of the back of the screen, and graduated from 0° round

FIG. 39.

Degrees Measured Radially from the Centre of the Screen.	For the Registration of the Readings obtained round each Circle.									
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	(160)	180	(210)	240						
16										
17										
18										
19										
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21										
22										
23										
24										
25										
26										
27										

Side of eye.....
Size of test object .....
Colour of test object .....

When the test object is visible, mark the degrees (circularly) in ordinary pencil writing; when it is dimly seen, place a ring round each entry; when it is lost to view, underline the figures. This system is illustrated opposite degree No. 15; the meaning of the record there given is that the test object was seen dimly from 160° to 180°, was lost from 180° to 210°, was again seen dimly from 210° to 240°, and was then clearly seen from 240° right round the circle to 160°.

Any other system of marking can be used, provided it is adhered to throughout.

to 360°, the figures reading clockwise. A black band on this disc denotes the line along which degrees of measure-

ment are marked on the face of the cloth. The whole is mounted upon an adjustable metal stand, to the top of which was fixed a stationary perimeter-pointer and a desk for carrying the sheet of paper on which the observations are recorded. Four hand knobs on the back of the disc make its rotation easy to accomplish.

The discs of blotting-paper can be readily cut with an old trephine blade of suitable size ; a large stock can thus be made in a few minutes.

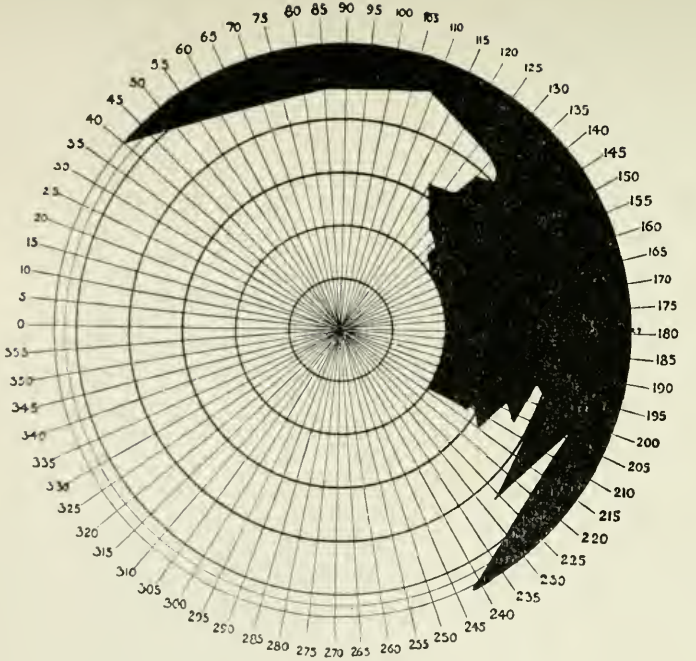
Method of working.—This varies a little according to whether the surgeon makes use of an assistant or not; the author invariably does so. He stands behind the perimeter and makes notes of the observations on the form shown in Fig. 39 The 5° and 10° circles are first explored, and then he works outward till he passes beyond the limits of the blind spot, or till he reaches the periphery. Whichever eye is being examined, each observation starts at 0°, and the wheel is rotated counter-clockwise (as seen from behind) from 0° to 360°, just as in Priestley Smith's method. The degrees at which the disc is lost, found, lost again, and so on, are noted in each rotation of the disc, and are subsequently transferred to one of the charts shown in Fig. 40. This work is greatly facilitated by the use of a pair of compasses armed with a lead pencil. Pads of charts are supplied with the instrument, each chart measuring 8 in. by 10 in.

The assistant, standing beside the patient, (1) takes care that the eye does not deviate from the fixation spot; (2) watches that the patient does not alter the distance of the eye from the screen ; and (3) moves the white disc along the velvet surface as directed.

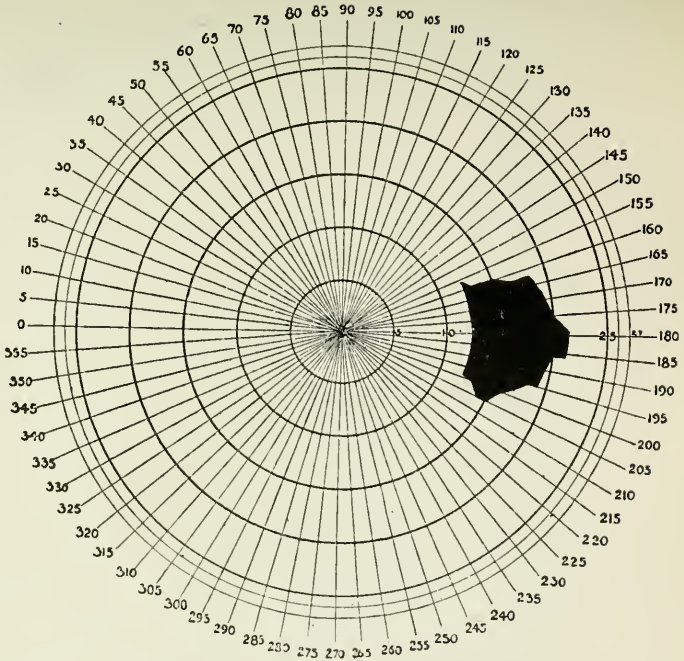
A full examination of the central field from 0° to 26° (each degree circle being examined in turn) takes from a quarter to half an hour, with an intelligent patient. To map out the blind spot alone takes from five to ten minutes.

The principles involved are three in number : (1) That of circular instead of radial examination of the field of vision (Priestley Smith), (2) that of the examination of

Fig. 40.



Defect mapped out by the author's scotometer a few days before operation. Note the irregularity of the endings of the upward and downward extensions of the scotoma. These points presumably represent lesions of small bundles of fibres.



Defect in the same case as the above, ten days after the relief of pressure by a successful trephining.

the field at intervals of 1°, instead of 5° or even 10°, as is so often done, and (3) that of the magnification of the scale on which the phenomena are recorded, making results easier to obtain, and more striking to the eye (Bjerrum).

Seidel's sign has already been described, and it has been stated that it has always appeared extraordinary to the writer that this scotoma should have been invariably figured and described as ending in a pointed or rounded single extremity ; it is not what might have been expected, on the assumption that the phenomenon is due to an injury to the fibres of the optic nerve, either on the disc or at its edge. Looking at the way in which the fibres emerge from the disc, it has always seemed probable that if the scotoma were charted with sufficient accuracy its upper and lower limits would present a more or less ragged edge, instead of ending in a point as described by Seidel. In other words, instead of one point we should expect to find a number of points corresponding to the numerous bundles of nerve fibres damaged at the edge of the disc. From the time that he first read Seidel's work in 1914, the writer, struck with the possibilities it presented, had been endeavouring to follow it up in his glaucoma material, but, as already stated, it was not until he obtained the new scotometer that he was able accurately to take readings all round the circle at each degree from the centre out to 26°. Previous to doing this, and when working by the radial method, he obtained unsatisfactory charts, representing scotomata resembling those described by Seidel. At the same time he was often puzzled by relative scotomata, which were very hard to map out, and which occurred at a distance from the blind spot defect. As soon, however, as the new instrument was installed, it was found easy to make accurate, consistent and self-explanatory charts. The ragged edge, which had been expected as the outcome of reasoning, materialised as a constant factor of the glaucoma chart. The paracentral scotomata found above or below the centre of vision or in

other regions, and separated from the blind spot defect by an area of acutely seeing retina, were quickly recognised for what they are. These points will be better realised by a reference to a number of the charts which have been taken. Before showing them, however, it is necessary to emphasise one fact, viz., that the features which these charts represent, strange as they at first sight appear, are not products of errors in a subjective examination. They occur again and again in cases of glaucoma, though sometimes less marked than in others. A repetition of the observation on the same patient reproduces them in just the same form. An intelligent patient's answers are clear, confident, and consistent, for the moving spot can be charted almost to a degree. It goes out and reappears so sharply that the observer can reverse the *rôle*, and, going over the same circle, can tell the patient exactly when it is lost or comes again into sight.

A device for fixing the head and so ensuring that the eye remains at the correct distance from the scotometer, and another for regulating the height of the centre of the disc by that of the eye, are supplied with the instrument. Another modification has been the employment of a larger disc graduated out to 32°; there are disadvantages as well as advantages attached to the big wheel. If a dark cloth is hung behind the small wheel to shut out light objects in the background, it is possible to work right out to 27°, and this meets all practical needs.

Before proceeding to discuss the new sign, it will be better to preface our remarks with a short description of the normal blind spot as it appears when traced by the new scotometer.

The Normal Blind Spot, as Marked Out by the New Scotometer.

A fairly large number of normal blind spots have been charted, sufficient at least to enable us to lay down certain data. The normal scotomata, thus mapped out, are usually

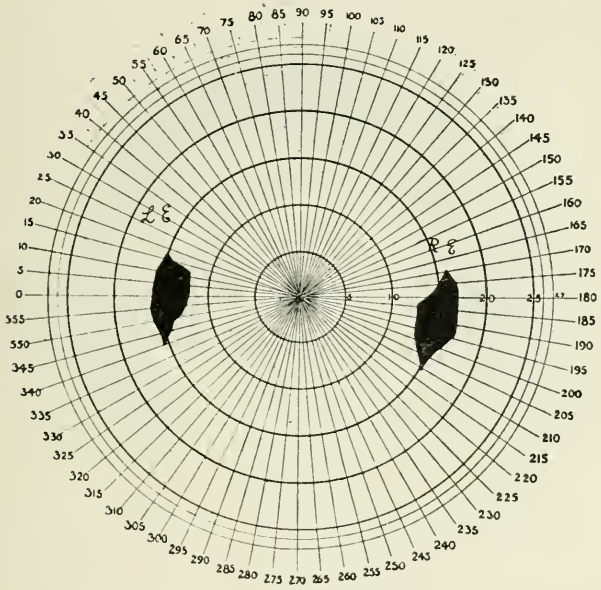
absolute throughout their extent, but sometimes reveal an area of relative scotoma around their edges. They are usually pointed, at times more, and at others less so (Fig. 41); the points may occur both above and below, or in only one of these neighbourhoods; rarely two points are seen below, and still more rarely above. An effort has been made to ascertain whether there is any connection between these points and the emergence areas of the retinal vessels, but no success in this direction can be definitely claimed. The shapes of the blind spots vary greatly, as also do their dimensions. Though there is usually a rough resemblance between the blind spots of the two eyes, they may vary considerably in shape, and to a lesser extent in dimensions. The average lateral measurement of a number of blind spots was 5·48°, and the average vertical measurement 8·15°. The maxima and minima recorded were laterally 7° and 4°, and vertically 10·5° and 6·25°. The findings are, therefore, generally in accord with those of other instruments used for the same purpose. In no case has a normal blind spot shown any resemblance whatever to the defect so regularly found in eyes affected with high tension. No opportunity has, however, yet occurred to chart a case of opaque nerve fibres with the new instrument; the results should be interesting; but in myopia, and in all the other conditions which give rise to an enlargement of the blind spot similar to that met with in glaucoma, there should be no difficulty in assigning a definite cause for the phenomenon.

The Value of the Sign in the Positive Diagnosis of Glaucoma.

It is imperative to recognise from the first that the sign now under consideration is not pathognomonic of glaucoma. So far as our knowledge at present extends, it enables us to recognise a lesion, or lesions, of a number of bundles of nerve fibres, either on the optic disc or at its edge; but it does not indicate what the specific nature of that lesion is.

When we meet with ophthalmoscopic or other evidence which leads us to suspect the presence of glaucoma, our diagnosis is very greatly strengthened, and may even be confirmed, if a chart of the paracentral field shows the new sign. Our greatest difficulties most commonly occur either in very early cases, or in very slowly progressive

Fig. 41.—Right and left.

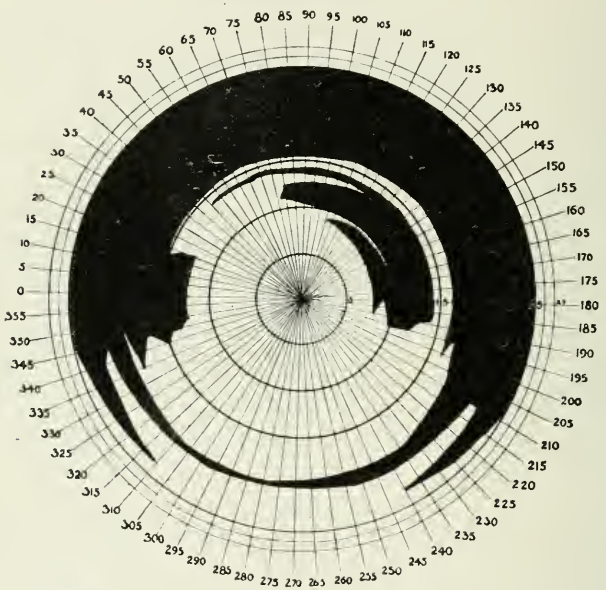


Miss F. S—. September 22nd, 1917.

cases of glaucoma, and in both these cases the new scotometer comes to our aid in a very practical manner. Fig. 40 is illustrative of this point; so also is Fig. 42, which was charted from a case sent to the writer by an ophthalmic surgeon, who was in difficulties, because, whilst he felt sure that the right eye was glaucomatous, he was in grave doubt about the condition of the left, in which the signs of high tension were all very feebly marked; the cupping was doubtful, the central v.a. was normal, and the v.f.s. were not contracted. The examination of the central and

paracentral field left no doubt as to the diagnosis. The results are shown in Fig. 42. Both eyes were trephined, and the correctness of the conclusion was confirmed by the extraordinary change which took place in the paracentral scotoma, and which may be seen in Fig. 43. A comparison of Figs. 42 and 43 show the ease with which

Fig. 42.—Left.



Mrs. J—. March 5th, 1918. Juv. glaucoma.

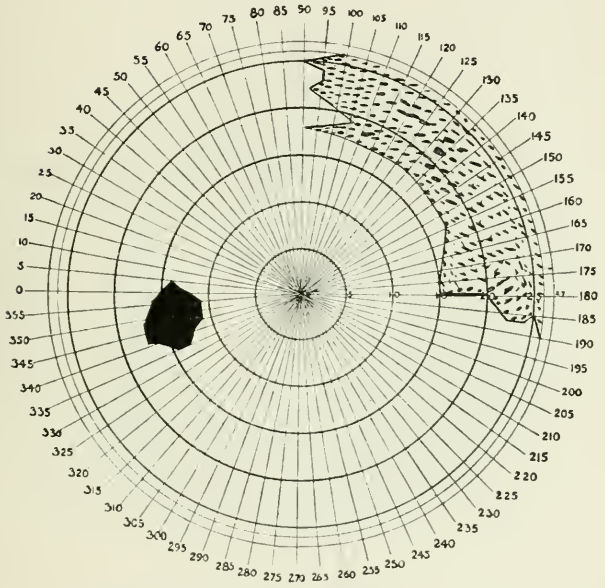
the results of therapeutic or operative treatment can be followed up, but this is a point which will be dealt with later.

Fig. 44 is from a suspected case of very early glaucoma in which the other evidence is of the slenderest. It will be observed that there is comparatively little increase of the area of absolute scotoma, whilst the relative area is so much enlarged as almost to constitute Bjerrum's sign. In addition to this, the detached areas of paracentral defect are to be noticed in Figs. 42 and 44. They will be dealt

with later, but should be noticed in the other charts as well.

There is a point of considerable interest which is well brought out by Fig. 44, viz., that the increase in the size of the blind spot is mainly confined to its upper and lower limits, whilst its breadth is relatively much less affected.

Fig. 43.—Left.

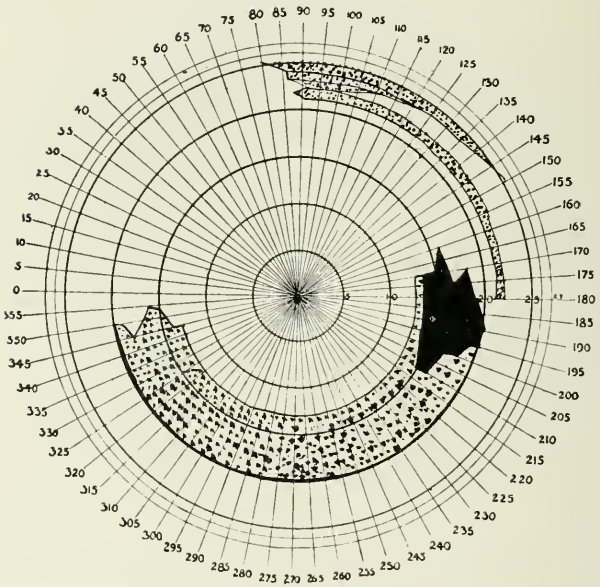


Mrs. J—. Eleventh day after operation, March 19th, 1918 ; trephined, March 7th, 1918.

Priestley Smith's dictum was that "it is necessary to explore the 10° circle as well as the 25° circle in order to exclude Bjerrum's sign"; and his opinion formerly was that "if there is no defect in either, there is no glaucoma." A case to which his attention was subsequently drawn somewhat shook his faith in these beliefs. It is submitted that the present work explains the difficulty. If we pinned our faith to Priestley Smith's earlier rule, and if we worked only along the horizontal meridian or close to it, we should

have diagnosed an absence of glaucoma in the case from which the chart in Fig. 44 was taken, whereas a fuller examination of the field shows at once the grave suspicion attaching to this case. As a matter of fact, it is being watched for further developments. Other interesting examples of the same kind of thing are to be freely found in our charts, but it is not possible to reproduce them for want of space.

Fig. 44.—Right.



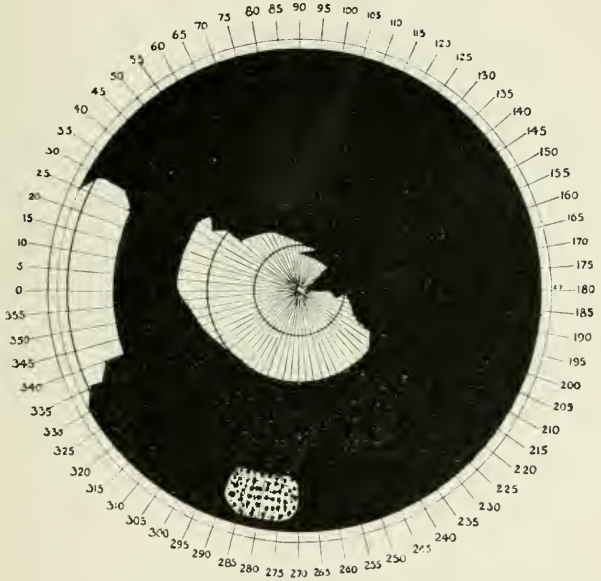
Mrs. L—. October 18th, 1917.

The Value of the Method in Revealing Important Alterations in the Central and Paracentral Field, either as the Result of Treatment or otherwise.

Several illustrations have already been given of the improvement of the central and paracentral fields as the result of operative interference (see Figs. 40, 42, and 43). Figs. 45 and 46 make an instructive addition. The scotomata had approached so close to the centre of vision

that the question had been raised whether operation was justifiable. The risks were pointed out to the patient, and though nearly eighty years of age, he was so convinced from his own observation that he was going steadily downhill towards blindness, that he had no hesitation in staking all on a single throw. The left eye was the worse. Fig. 45 was its field taken just before the operation, and

FIG. 45.—Left.



Mr. C—. October 26th, 1917.

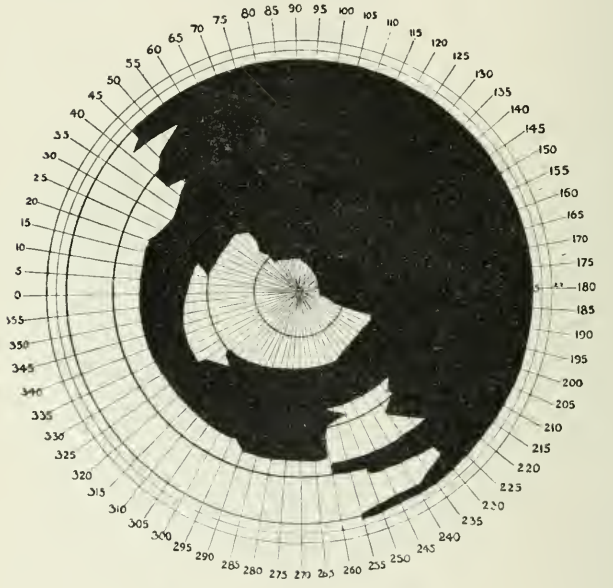
Fig. 46 six weeks later. It is instructive to observe the way in which the small relative scotoma below has broken through and the improvement in the available area of vision. He has not been seen since, but is due again shortly. The same point is illustrated in other charts, but space is not available for their reproduction.

Figs. 47 and 48 have quite a different interest; they show the paracentral scotomata before and after operation, and it will be observed that, though a successful and

uneventful trephining completely reduced the rise in intra-ocular pressure which accompanied an attack of secondary glaucoma, nevertheless, the area of defect showed a marked increase, a fact of which the patient was fully aware.

From the foregoing observations and illustrations it is

Fig. 46.—Left.

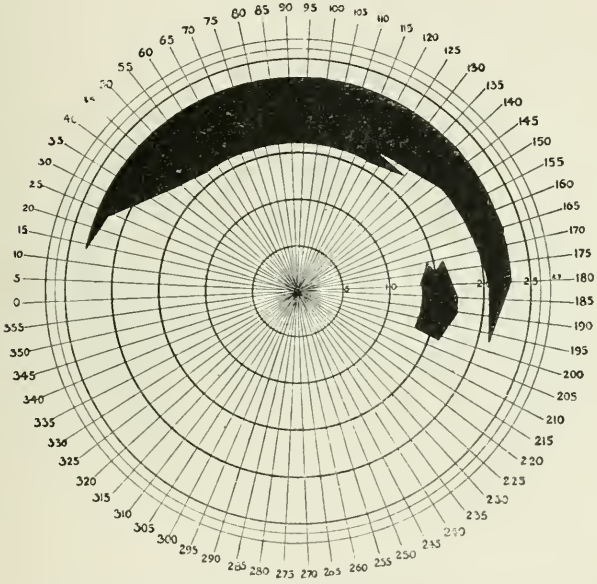


Mr. C—. December 14th, 1917.

clear that we have here a means whereby we can easily and accurately measure the defects in the central and paracentral fields of vision, and can take note of the changes which occur in them from time to time as the result of operative or other treatment, or of the progress of the disease apart from any interference. Many statements made by patients, which at first sight appear contradictory, are shown to be quite consistent, in the light of the evidence obtained from these charts. For instance, it may be found that after operation central visual acuity is

unchanged and the visual field, taken with a 5 mm. object on an ordinary perimeter, remains full, and yet the patient may assert in the most positive manner that he sees worse or better than he did before. The changes revealed by the new scotometer will clear up the mystery.

Fig. 47.—Right.



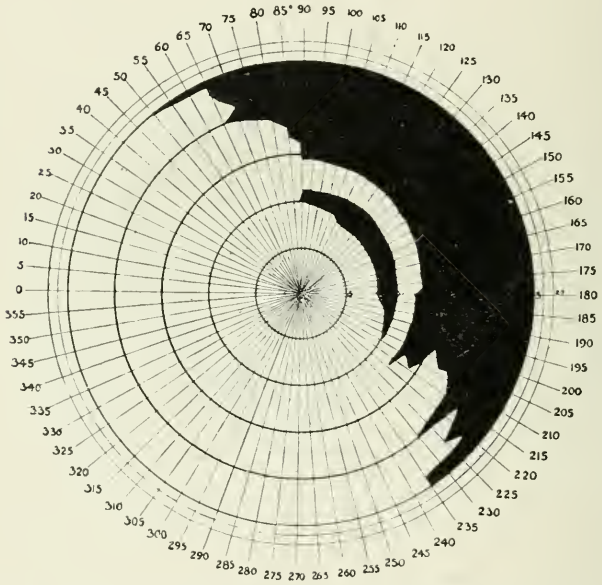
The Rev. J. B—. February 7th, 1918.
R.E.V. $\bar{c}$ + 1·0 sph. = + 3·0 -› = $\frac{5}{6}^{5}$ ±.

The Value of the Method in proving that a Case is not Glaucomatous.

This point was well illustrated by the following case: The patient, whose father had been successfully trephined for glaucoma, consulted an ophthalmic surgeon, who had told him that he had suspicious cupping of the optic discs. In view of his family history, this opinion caused him some alarm. The cupping did not appear to the writer to be of the glaucomatous type, nor could any other signs of a

pathological rise in tension be elicited, even after a thorough and routine examination. The blind spots were accordingly mapped out and proved to lie well within normal limits, thus definitely settling the question; for, to the writer's mind, the absence of changes in the blind spot is conclusive against the diagnosis of glaucoma. A

Fig. 48.—Right.



The Rev. J. B—. February 21st, 1918. Showing large increase of scotoma following operative release of tension (fourteen days after trephining).

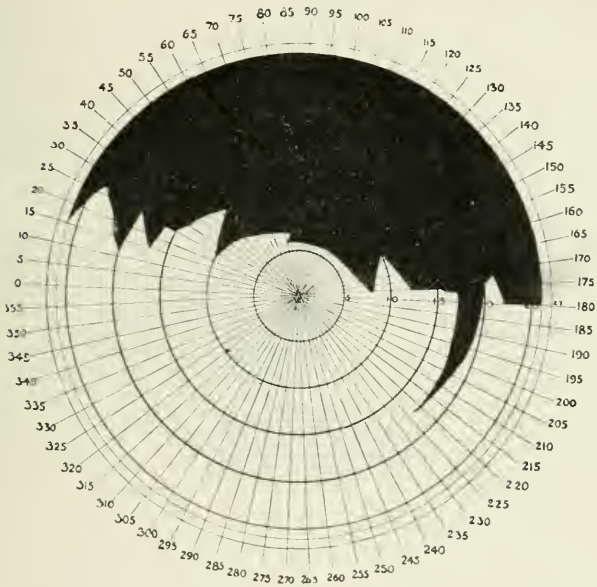
measurement of the patient's corneal diameters showed that these were above the average, and it was therefore possible to assure him not only that he had not got glaucoma, but also that he was unlikely to develop it in the future.

The Explanation of Detached Areas of Paracentral Defect.

The anatomical distribution of the nerve fibres in the retina has not been worked out with absolute certainty,

but it is generally accepted that those fibres, which lie nearest the periphery of the nerve, supply the juxta-papillary areas of the retina, whilst the fibres at the centre of the nerve pass out to the retinal periphery. This arrangement suggests an obvious explanation of the spread of the blind spot outward in different

Fig. 49.—Right.



Mrs. H—, æt. 67 years. March 19th, 1918. (Glaucoma.)

directions in glaucomatous eyes, for, as has been pointed out by Collins and Mayou, the most peripheral fibres are the most likely to be injured by pressure against the edge of the sclerotic as they pass out of the glaucomatous cup. How sharp the ring-edge of such a cup may be can be gathered from an anatomical examination of eyes which have long been subject to high tension. How, then, can we explain the not infrequent presence of detached areas of scotoma in the

paracentral fields of glaucomatous subjects? May it be that we are here dealing with variations in the anatomical arrangements of the nerve fibres? This hardly seems likely. It would appear much more probable that the answer is to be sought and found in lesions to the nerve fibres on the disc itself, and not at its edge. From close

Fig. 50.—Right.

Miss E. F—. January 14th, 1918.

examination of a glaucomatous cup, it seems clear that the fibres which originally passed down close to the centre of the papilla must have undergone much more stretching in order to occupy their new positions than did those which from the first ran in their natural course along the shelving side of the scleral foramen. Possibly it is to some form of injury, inflicted in this way, that we are to ascribe the causation of the phenomena of detached paracentral scotomata (Figs. 42 and 44).

Invasions of the Central Area of the Field.

It has long been known that, although in the vast majority of cases it is the rule that glaucoma spares the centre of the field of vision, very marked exceptions to this rule are known to occur. It would take us too far were we to attempt to argue why the papillo-macular bundle should so often escape injury, and should at times be so definitely overwhelmed by it, but the clinical significance of hemianopia, or of total obliteration of the central area, is such as to demand the very careful study of the subject, whenever opportunity offers. Charts, such as that shown in Fig. 49, have, under these circumstances, a special interest, which is in no way lessened by the fact that a defect, which it would be hard indeed to distinguish from it, may be met with in a case of high myopia, without any apparent rise in intra-ocular pressure. The word "apparent" is used advisedly. This point is excellently illustrated by Fig. 50, taken from a high myope.

This observation leads one to repeat what has already been said as to the absence of pathognomonic significance of the sign when present. This principle was clearly recognised by Bjerrum and his followers in all their work, for they knew that defects closely similar to those they described could be found in *any* pathological condition which interfered with the integrity of definite nerve bundles either on the disc or in its neighbourhood. So far the writer has only been able to study cases of myopia, beside those of glaucoma; but he has been able to satisfy himself that even comparatively high myopia may fail to show the characteristic sign we are discussing, which appears to be met with only when staphylomatous changes are, or have been, in progress. It seems not unlikely that the mapping out of the blind spots in these cases may furnish valuable data as to the progress of a case. He has been collecting material of this kind, but unfortunately it accumulates slowly, save in exceptional classes of practice.

Major Derby said he would like to express his agreement with Col. Elliot and the others who had spoken as to the value of the measurement of the blind spot as a diagnostic aid in the recognition of glaucoma, also as to the progress of myopia. He considered it was the most important single diagnostic sign there was. Second to that—although he knew some of his hearers did not feel the same way about it—was the proper use of the scotometer. He had never been able to explain the tendency of scotomata to assume the form which Col. Elliot described when examining with the Priestley Smith scotometer, turning it round. He had never seen cases in which glaucoma had existed for some time in which there had been any enlargement of the field. He could not help feeling, though he knew it was pessimistic, that part of it was due to the optimism of the surgeon, and part to the desire of the patient to please.

Mr. Harrison Butler remarked that he was loth to criticise the opinions of either Col. Elliot or Mr. Priestley Smith, but he thought that when a concentric defect in the field was being sought for, the object should move in a radial fashion and not meridionally. A perimeter which rotated upon a centre was liable to give very symmetrical scotomata, and they would tend to be mapped out in a concentric fashion. If, on the other hand, radial scotomata were sought for by an object moving radially, the field would tend to be limited by lines radiating from the centre. He thought that it was far safer to use the plain Bjerrum screen and hold the object by hand. It could be then moved in any way desired, and there would not be the same tendency to limit the scotomata by circles or by radial lines. He thought that the jagged ends of the scotomata, as shown by Col. Elliot, were artefacts caused by the very mechanical method employed to map them out. The beautiful diagrams shown were far too symmetrical to be natural.

Mr. Brooksbank James said he agreed with the remarks of Mr. Harrison Butler. He always took a patient's fields

on a smaller apparatus, at a distance of 30 cm., with a double bar, the end of one of which carried a white object, while the other pricked on the chart behind. He thought the result was more accurate than by the machines which had been demonstrated.

The PRESIDENT said he had been working for a short time with Col. Elliot's scotometer, and was able to confirm the results he obtained. He had found the same sort of jagged edges in the scotomatous areas in cases of glaucoma. Some experience was necessary in using the instrument to get familiar with it, and a good deal of time was required to work the results out at every five degrees. The extent of the scotoma which was shown in glaucoma cases was often surprising. Taking the fields with an ordinary perimeter and with this scotometer might be compared to viewing a microscope specimen with a low and with a high power, on account of the increased detail revealed with Col. Elliot's instrument in a small area. We see sometimes cases of glaucoma in which the field taken with the perimeter and the central vision are the same as when previously tested, and where we are therefore inclined to say the patient's condition has not deteriorated. The patient, however, says that he is worse; this is to be explained by the extension of the scotoma round the fixation spot, which is well shown up by this instrument.

Mr. CRIDLAND said that, having used the apparatus for three months, he could confirm all that the President and Col. Elliot had said.

Mr. GEORGE YOUNG said he had used the Bjerrum curtain very extensively since it first came out. He also made one for the New York Eye and Ear Infirmary, where he worked a great deal with it. He could map out a chart in the same exact way with it as Col. Elliot had. He once mapped out his own, and worked out the retinal vessels in detail from the optic nerve to the periphery. If Col. Elliot could confirm the impression that he had had actual improvement of vision after his trephining and an increased field, it was telling members of

the profession that which ought to make them prick up their ears concerning that gentleman's method of operating. He had thought there was no such thing as improvement in vision and the visual field after an operation for glaucoma, and if such could be demonstrated it was a great step forward.

Mr. Giri asked whether by employing a 1 mm. test-object and moving it along correspondingly smaller intervals, the same result as obtained by Col. Elliot on his circular rotatory screen could not be achieved on the square, non-rotatory screen.

Lieut.-Col. Elliot, in reply, said he had described the instrument and the results just as he found them in the hope that others would try it too; they must be guided by the results of their own experience. One could, with this instrument, chart a man's field, and on going over it again one would have just the same peaks and jags as at the former examination. He thought the reason observers had not got that evidence of jags in cases of glaucoma was that most of them worked at five- or ten- degree intervals instead of at one degree. He did not see how there could be real differences in the result obtained by this method and by that of Bjerrum. The method he had just described was the quicker. He admitted that the method took time, but the valuable indications it gave were, he thought, well worth the time spent. With regard to the remark concerning improvement in the fields, he had shown, this evening, charts which showed both improvement and deterioration; he was far from being the first to show signs of improvement in fields after operation. Van der Hoeve wrote a paper of great value, in which he showed many cases which he had followed up from week to week; he (the speaker) had reproduced Van der Hoeve's chart in his book on glaucoma. Improvement in the visual fields after operation was a matter of common knowledge. To measure them accurately was a more difficult matter.

2. *Large perimeter with eccentric system of registration.*

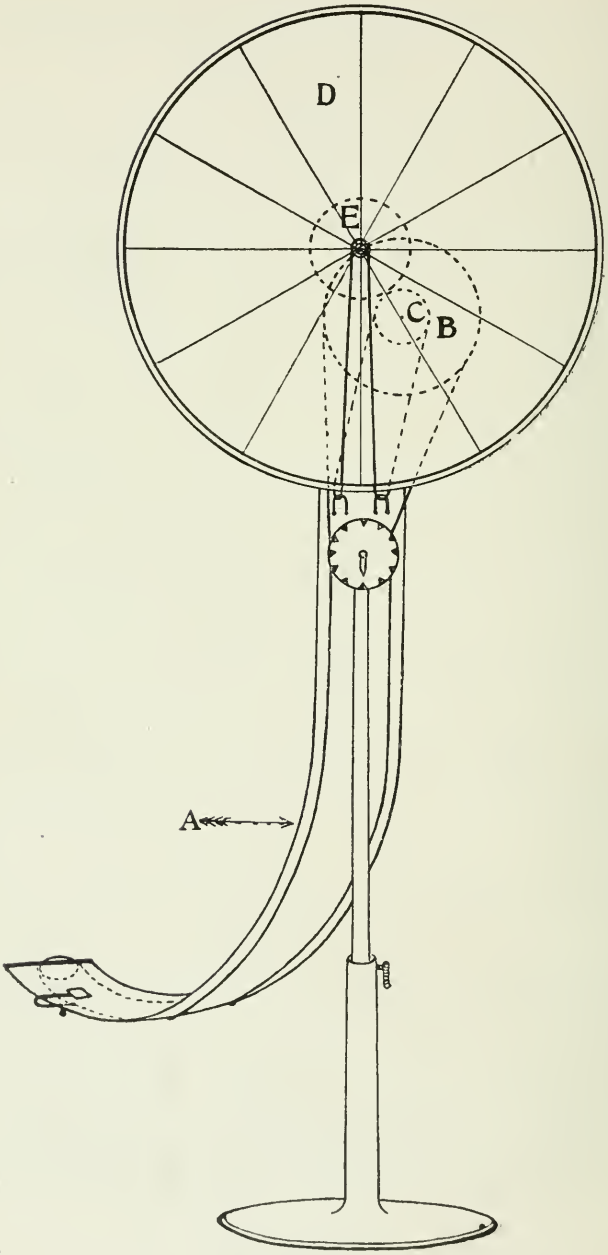
By A. C. Hudson.

I had hoped to be able to show two new patterns of perimeter, but owing to difficulties with regard to labour and material it has been found possible to construct only one instrument. In this there is an endeavour to obtain the advantages as regards large scale of measurement afforded by the Bjerrum screen, while obviating the disadvantages of the latter dependent on the necessary limitation of the area of the visual field within the scope of examination, the variability in size of the angle at the nodal point of the eye subtended by any test object, according as the latter is more or less centrally situated in the field, and the primitive method of registration.

The arc (A) of the perimeter (Fig. 51) is the quadrant of a circle having a radius of one meter. The test object, which is in the form of a flat-headed nail, the size and colour of which can be varied as desired, is actuated by a wire passing round the disc (B), the dimensions of which are such that one revolution and a half correspond with an excursion of the test object from one end of the arc to the other. Centred upon, and attached to, the same axle as this disc is a second disc (C), of one-third the diameter of the first, which actuates a cord carrying a pointer and travelling over the posterior surface of the large screen (D). This screen is so weighted that under the influence of gravity its vertical meridian remains constant whatever the position of the arc of the perimeter, and, its surface being mapped out by a concentric and radial degree chart, a record of the indications of the pointer upon this surface maps out a chart of the whole field one meter in diameter. A means is thus afforded of studying the field in considerable detail.

To obtain a record of the field of vision suitable for preservation for future reference, the instrument should be provided with a disc (E), centred upon, and attached to, the same axle as the large screen (D), and capable of

FIG. 51.



(Diagrammatic.)

carrying on its anterior surface a detachable paper chart, 20 cm. in diameter, over the surface of which travels a pointer controlled by a rack and pinion actuated by the disc (B) in such a manner that a 10 cm. excursion of the pointer corresponds with an excursion of the test object from one end of the arc to the other, readings of the pointer being recorded by a pin-prick mechanism.

Dr. George Mackay said it was now fully twenty years since he devised a meter perimeter, because he found the Priestley Smith and McHardy instruments gave one too short a range. They are particularly inconvenient for presbyopic and hypermetropic eyes, and do not allow the use of objects of sufficient fineness. The arc of his perimeter subtends an angle of 135°, and consists of a thin band of blackened metal, 10 cm. wide, pivoted on a heavy upright metal pillar, and is adjustable to a height which can be varied to suit each patient when seated. The artisan whom he employed worked out an automatic recording apparatus, situated behind the fixation point, something on the lines of McHardy's device, but with the additional advantage that the test objects and record could be carried to and fro across the middle line in any position of the arc. He brought the instrument up to London and placed it in the hands of a well-known firm of opticians in order to see whether they could improve on the details of construction, and undertake to supply it to any colleagues who might desire it. After some months' silence they informed him that they found the apparatus too cumbrous to produce in their workshops, but, in the meantime, having taken much of it to pieces in their attempts at improvement, they had succeeded in losing some essential parts, and returned it to him in a derelict and useless state as regards the recording apparatus. Unfortunately the local mechanic whom he had first employed retired from business about that time, and he had been unable to reconstruct the automatic recording mechanism, but he had used the simple arc for many

years with considerable advantage for the measurement of fields of vision and muscular anomalies. Any perimeter has the advantage over a campimeter, that the test objects can be moved circumferentially or radially and still subtend the same angular dimensions throughout the field.

XII. INTRAOCULAR TENSION.

1. *An experimental investigation as to some of the effects of hypotony in rabbits' eyes.*

By E. Treacher Collins.

(With Plates II—V.)

In a paper on the sequelæ of hypotony which I read before this Society last year, I brought forward evidence which seemed to show that in an eye in the condition of hypotony the normal excretion of aqueous humour by the veins of the iris becomes arrested, and that, instead, an exudation of lymph takes place through their walls into the anterior chamber. This exudation alters the normal consistency of the aqueous by increasing its percentage of proteids and rendering it spontaneously coagulable.

It occurred to me, when writing the paper, that further useful evidence on the matter might be obtained by the performance of a few simple experiments on rabbits' eyes, these experiments to consist of lowering the intraocular pressure by letting out fluid from the anterior chamber, or from the vitreous chamber, and then, after an interval of varying duration, to excise the eyes and harden them in Zenker's solution.

Eyes hardened in this way show excellently any albuminous exudate as a coagulum, in both macroscopical and microscopical specimens.

I was contemplating going through the lengthy preliminaries which the carrying out of any such experiments in this country necessitates, when, on speaking to Col. Elliot on the matter, he most kindly offered to write to Major Kirkpatrick in Madras and get him to perform the experiments for me.

I wrote out what it was I wanted done, and in due course the rabbits' eyes, hardened and ready for examination, arrived from India. I need not say how deeply indebted I am to Major Kirkpatrick for the trouble he has so kindly taken in the matter.

Five rabbits' eyes have been experimented on. In three the tension was lowered by the performance of a paracentesis of the anterior chamber, the eyes being afterwards removed at intervals of thirty-four minutes, thirty-five minutes, and sixty-two minutes respectively. In the other two the vitreous chamber was trephined, the eyes being removed afterwards at intervals of sixty-four and fifty-nine minutes respectively. All the specimens were fixed in Zenker's fluid for twenty-four hours, and then, after thorough washing, placed in spirit. On receiving the specimens I soaked the spirit out, froze them in a mixture of ice and salt, and divided each of them in half by an anterior-posterior section. A rabbit's eyes, removed immediately after death, upon which no operation had been performed, I treated in precisely similar fashion for the sake of comparison.

Macroscopical examination of the eyeballs after they had been cut in half showed, that in all those in which the tension had been lowered by operation, the anterior chamber was entirely filled by an opaque coagulum (Pl. II, figs. 1 and 2). The eyes which had not been operated on, and in which the tension had not been reduced, showed no such coagulum in the anterior chamber, the aqueous humour being liquid and clear.

Microscopical examination of the coagulum shows it to be of a granular character (Pl. III, fig. 3), and that whilst in all the specimens it entirely fills the anterior chamber, passing across the pupillary opening in the iris, in none of them does it extend through the pupil into the posterior chamber. In the eyes in which a paracentesis of the anterior chamber was performed, there is, in addition to the coagulum in the anterior chamber, some coagulum of a similar character on the inner surface of the anterior part of

PLATE II.

Illustrating Mr. E. Treacher Collins's paper on An Experimental Investigation as to Some of the Effects of Hypotony in Rabbits' Eyes (p. 217).

[The figures illustrating this article have been reproduced from photographs of the writer's specimens, kindly taken for him by Mrs. Elliot.]

Fig. 1.—Shows half a rabbit's eye removed sixty-two minutes after paracentesis of the anterior chamber and hardened in Zenker's solution. The anterior chamber is filled with coagulum, which does not pass backwards through the pupil. There is no exudation into the vitreous, and the lens has fallen backwards.

Fig. 2.—Shows half a rabbit's eye removed sixty-four minutes after trephining of the vitreous chamber and hardened in Zenker's solution. The anterior chamber is filled with coagulum, which does not pass backwards through the pupil. The vitreous is increased in firmness by the formation of coagulum in it, so the lens has not fallen back.

Fig. 1.

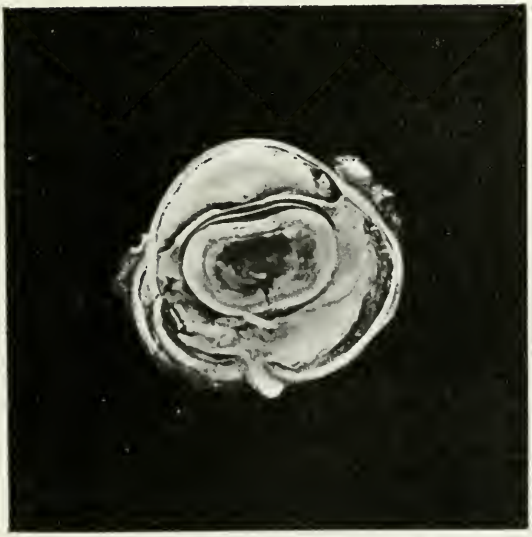


Fig. 2.

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PLATE III.

Illustrating Mr. E. Treacher Collins's paper on An Experimental Investigation as to Some of the Effects of Hypotony in Rabbits' Eyes (p. 217).

FIG. 3.—Microscopical section of the iris, ciliary processes, and coagulum in anterior chamber of eye shown in Fig. 1. The coagulum filling the anterior chamber is of a granular character. The iris has fallen back somewhat from it in the preparation of the specimen. There is some coagulum about the anterior part of the ciliary body, but there is no continuity between it and that in the anterior chamber.

FIG. 4.—Microscopical section of the angle of the anterior chamber, and of the ciliary processes, from the same eye under higher magnification. The coagulum about the anterior part of the ciliary body is more clearly shown.

Fig. 3.

Fig. 4.

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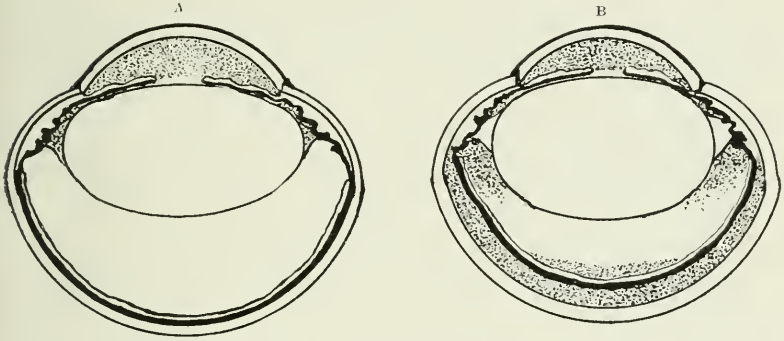
the ciliary body and the peripheral portion of the posterior surface of the iris (Pl. III, fig. 4). In none of the specimens is there any continuity between this coagulum about the ciliary processes and that in the anterior chamber; everywhere they are widely separated.

In the eyes in which the tension had been lowered by evacuation of the aqueous humour the vitreous presents its normal characteristics. In the specimens as they melted, after being frozen and divided in half, the lens

FIG. 52.



The dotted part in A shows the position of the albuminous exudate after paracentesis of the anterior chamber. The dotted part in B shows the position of the albuminous exudate after trephining of the vitreous chamber.

tended to fall backwards away from the posterior surface of the iris, as is shown in the photograph (Pl. II, fig. 1). In them, also, the choroid lies in its normal relation to the sclerotic, there being no exudation into the supra-choroidal lymph spaces. On the inner surface of the ciliary processes at the anterior part of the ciliary body several bleb-like elevations of their lining epithelium are to be seen, most of which contain a granular coagulum. The appearance in the eyes in which sixty-two minutes had elapsed since the paracentesis are practically the same as those in which there had been an interval of thirty-four and thirty-five minutes.

The two eyes in which the vitreous chamber was trephined show some changes markedly different from those in which the tension was lowered by evacuation of the aqueous. These differences, though of the same character in both eyes operated on, are much more pronounced in the one which was removed sixty-four minutes after operation than in the one in which only fifty-nine minutes had elapsed ; probably, in addition to the slightly greater length of time, there has also been a greater degree of hypotony produced in the former.

The vitreous humour in these eyes is opaque and of firmer consistency than in either the normal eyes, or the eyes in which the aqueous humour has been evacuated (Pl. II, fig. 2). This alteration is found microscopically to be chiefly due to exudate, which shows itself as a granular coagulum, extending backwards from the posterior surface of the ciliary body, *i.e.* the posterior surface of the ciliary processes and its short non-plicated part (Pl. IV, fig. 5).

In these vitreous-trephined eyes there is only a very slight trace of granular coagulum on the inner surface of the anterior part of the ciliary body, much less than in the eyes in which paracentesis of the anterior chamber has been performed. In the anterior part of the ciliary body, however, blister-like elevations of the lining epithelium, containing granular material, are a conspicuous feature (Pl. IV, fig. 6). As already mentioned, in these eyes the anterior chamber, like the eyes in which the aqueous was evacuated, is filled with a coagulum which passes across, but not through the pupil (Pl. II, fig. 2). In the eye which was removed fifty-nine minutes after operation, and in which presumably the tension was also less diminished, the clot from the anterior chamber floated out easily as the specimen melted after being frozen and cut in half. In the eye which was removed sixty-four minutes after the vitreous chamber was trephined the clot in the anterior chamber was denser, and retained its position more tenaciously.

The firm consistency of the vitreous in this latter

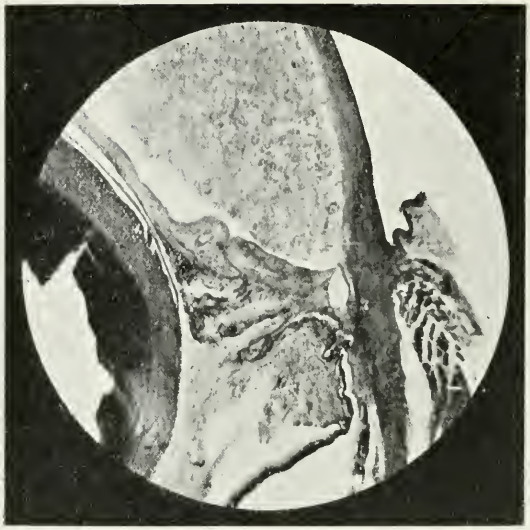


Fig. 5.

Fig. 6.

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PLATE IV.

Illustrating Mr. E. Treacher Collins's paper on An Experimental Investigation as to Some of the Effects of Hypotony in Rabbits' Eyes (p. 217).

Fig. 5.—Microscopical section of the angle of the anterior chamber and ciliary body of the eye shown in Fig. 2. The granular coagulum is shown filling the anterior chamber. There is no coagulum about the anterior part of the ciliary body, but there is about its posterior part, extending backwards from it into the vitreous humour.

Fig. 6.—Microscopical section of part of a ciliary process, from the anterior part of the ciliary body of the same eye, under higher magnification. Several blister-like elevations of the lining epithelium are shown.

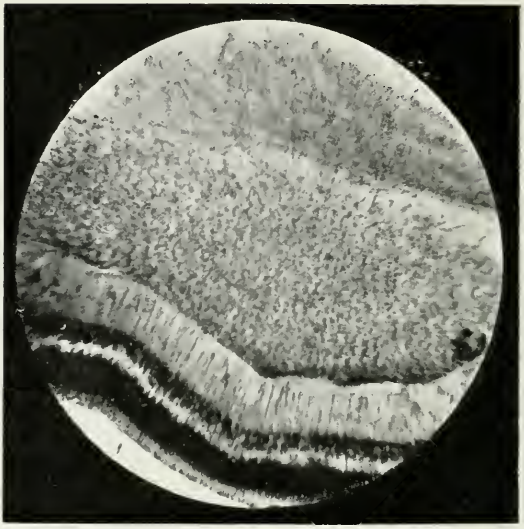

Fig. 7.

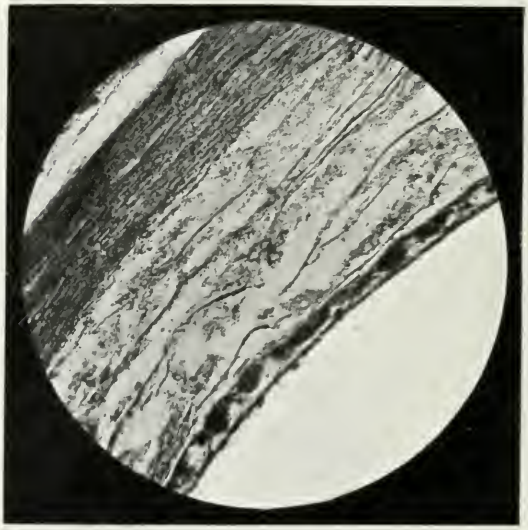

Fig. 8.

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PLATE V.

Illustrating Mr. E. Treacher Collins's paper on An Experimental Investigation as to Some of the Effects of Hypotony in Rabbits' Eyes (p. 217).

Fig. 7.—Microscopical section of the retina and vitreous humour from the posterior part of the eye shown in Fig. 2. A granular coagulum is shown between the retina and vitreous humour.

Fig. 8.—Microscopical section of the sclerotic and choroid from the eye shown in Fig. 2. Granular coagulum is shown in the lymph spaces between the two coats.

specimen is due not only to exudation from the ciliary body, but also to some extent to a granular coagulum at the posterior part of the eye on the inner surface of the retina. This coagulum lies between a hyaline membrane on the inner surface of the retina and the delicate trabecular network of the vitreous, which is displaced forwards (Pl. V, fig. 7). It is difficult to decide if the hyaline membrane is the membrana limitans interna of the retina or the posterior hyaloid membrane of the vitreous.

A further striking difference between the specimens in which the aqueous had been evacuated and those in which the vitreous chamber was opened, is, that in the latter granular coagulum fills the supra-choroidal lymph spaces, and has slightly separated the choroid from the sclerotic (Pl. V, fig. 8).

Such being the changes in the eyes produced by these experiments, I will now proceed to discuss the inferences which I think may be drawn from them.

To commence with, they show that when hypotony is produced in a rabbit's eye, *i. e.* when the pressure in the interior of the eye becomes markedly less than the pressure of the blood in the intraocular blood-vessels, an effusion of serum into the eye takes place.

If the hypotony is produced by escape of fluid from the anterior chamber, the serous effusion is only met with in parts of the eye in front of the lens and anterior hyaloid membrane of the vitreous. If the hypotony is produced by escape of fluid from the vitreous chamber, the serous effusion is poured out not only into that chamber and the parts around it, but also into parts in front of the vitreous and lens (Fig. 52). Apparently escape of the aqueous humour produces less lowering of pressure in the vitreous chamber than escape of fluid from the vitreous produces in the anterior chamber.

When hypotony occurs from escape of fluid from the vitreous chamber there is exudation of serum into the lymph spaces between the choroid and sclerotic, which in all probability comes from the large veins on the outer

surface of the choroid (*vide* "Sequelæ of Hypotony," *Trans. Oph. Soc.*, vol. xxxvii, p. 287).

It also gives rise to exudation of serum on the inner surface of the retina, between it and the vitreous humour, which presumably comes from the retinal veins.

The production of hypotony in a rabbit's eye causes an exudation of serum from the ciliary body. If the hypotony is the result of the escape of aqueous humour, the exudate is entirely from the anterior part of the ciliary body into the posterior chamber. If it results from escape of fluid from the vitreous, it is mainly from the posterior part of the ciliary body into the vitreous chamber.

This would seem to suggest that under normal circumstances the aqueous humour is secreted from the anterior part of the ciliary body, whilst the fluid element of the vitreous is derived from the posterior part of that structure.

When hypotony is produced by escape of fluid from the vitreous there is but very little serous exudate into the posterior chamber from the anterior part of the ciliary body. Its lining epithelium is, however, found in several places to be raised up in the form of blisters containing a granular coagulum. This would seem to show that a serous exudation from the capillaries of the ciliary body finds some impediment from the epithelium lining them to its passage into the posterior chamber. When the pressure in that chamber is only slightly reduced it tends to raise the epithelium up rather than pass through it. When, however, the pressure in the posterior chamber is very considerably reduced, as it is after the evacuation of the aqueous, then the impediment is overcome, and some serous exudate is able to make its way into the posterior chamber.

When hypotony is produced, either by escape of fluid from the anterior chamber or from the vitreous chamber, serous exudation accumulates in the anterior chamber. It seems unlikely that this serous exudate can have come to any great extent from the ciliary body, for when the hypotony is produced by escape of fluid from the vitreous,

only a trace of granular coagulum is found in the posterior chamber in the vicinity of the ciliary processes, whilst the anterior chamber is completely filled by such coagulum. When the hypotony is produced by the evacuation of the aqueous humour, the coagulum in the posterior chamber is confined to its peripheral part, and that in the anterior chamber does not pass back through the pupil. Had the serous exudate in the anterior chamber been derived from the ciliary body, some continuity between the coagulum in the anterior chamber and in the posterior chamber might have been expected, instead of such wide separation between them. The most probable source of the serous effusion in the anterior chamber would seem to be the veins on the anterior surface of the iris. These, under normal conditions, have been shown to absorb aqueous humour and serve as excretory channels for it. When, however, the pressure in the anterior chamber becomes considerably reduced, below that in the iritic veins, the normal process is apparently reversed, and serum exudes through their walls into the anterior chamber.

Lieut.-Col. Elliot said it had been his privilege to see Mr. Collins' original specimens, also to read the paper just read in advance. With his accustomed modesty, the President had been content to state the bare facts. But he (the speaker) considered that the value of the paper would be found to lie in the deductions which would be permissible from these facts. He thought all would agree that the abundance of the exudate in any part of the eye, as Mr. Collins had pointed out, was an evidence of the difference between the pressure within and the pressure without the vessels at that point. He drew attention specially to that matter, because in a recent paper by a French author, as well as in other writings, there was a tendency to advocate the idea—which to him was incomprehensible—that there was no circulation through the eye. He was at a loss to know how that idea could be held on either physiological or pathological

grounds. If there were differences of pressure in different parts of the eye, there must be a circulation from the points of higher to those of lower pressure, and *vice versâ*. It might be said by some that the conditions were artificial. At all events, the President's experiments had shown, quite conclusively, that within the tunic of the eyeball it was possible to establish very decided differences of pressure. It could not be said there was a single constant level of pressure throughout the whole eyeball when evidence such as Mr. Collins had produced was seen. In this alone the President had rendered very valuable service, by proving again what one would not have thought was necessary to demonstrate, save for the writings he had mentioned. There was also another point of great interest: Mr. Priestley Smith long ago suggested that the cause of certain forms of glaucoma—those forms in which the iris was pushed far forward, and the vitreous appeared to be over-filled—might be due to a pathological secretion from the posterior part of the ciliary body. It had been suggested that the posterior part of the ciliary body secreted fluid into the vitreous, and the anterior part secreted fluid into the anterior chamber. So far as he knew, there had been no anatomical evidence of that previously produced, and therefore he congratulated the President on the very valuable paper he had laid before the meeting.

Sir George Berry said he would like to second the congratulatory remarks of Col. Elliot, and say how extremely obliged the Society was for the narration of these very instructive experiments. He took it that all the experiments had to do with a sudden diminution of tension; and one point which occurred to him was that it would seem desirable to get further information as to what happened when the tension was only gradually reduced. For instance, it would be valuable to know what happened in interstitial keratitis when the eye gradually became softer. He could scarcely think that the albuminous exudate in these cases could be of exactly the same nature. That was a point which still seemed to stand in

need of elucidation. Others had been very clearly put, and, he thought, established by the President, namely, that the iris vessels exuded material into the anterior chamber, and that it was the anterior part of the ciliary body which supplied part, at all events, of the aqueous humour.

Mr. George Young said the President's point, that trephining over the vitreous had more effect on the anterior chamber than trephining the anterior chamber had on the vitreous, opened to him a completely new field. It was an extraordinarily interesting point of view. He asked whether the President did not think that might be the explanation of the fact that an operation which he (the speaker) suggested in New York, in 1912, for reducing the tension in chronic glaucoma had been, in his hands, highly successful.* He then maintained that it was unnecessary to enter the anterior chamber at all. Trephining in the sclera, doing a double sclerectomy without the trephine entering the anterior chamber, produced at once diminution of tension, and permanently so. The case on which he operated at the time of that paper, in that way, was one of absolute glaucoma with a tension of *plus* 3, and he heard periodically that the tension still remained normal, and that there had never been any recurrence of pain. In that case he made no communication with the anterior chamber. He had since done the same thing repeatedly: in fact he now did nothing else for such cases, and the tension had invariably been successfully reduced. He wondered whether it would not be possible to trephine far back if trephining over the vitreous had such a great effect on the anterior chamber. Mr. Greening, of New York, pointed out at the time that the only objection to his (Mr. Young's) operation was that it was directly over the ciliary body. But he had not had complications due to that provided he remained close to the limbus. But it might be well to try trephining far back, quite beyond the area of the danger zone. Did Mr. Collins think there might be anything in that?

* *Ophthalmoscope*, May, 1912, and April, 1914.

Mr. Thomson Henderson said he would like to hear from the President how soon after these eyes were enucleated they were put into the fixing agent. He had himself noticed that when eyes were put immediately into even such a weak solution as 2 per cent. they tended to exhibit an exudate on the iris surface. He therefore always left his eyes in normal saline solution for some hours, and only after that interval did he put them into the formalin. His idea was that the tissue was still alive immediately after enucleation, and that the hardening agent irritated these tissues, and that this was responsible for the occurrence of the exudate. He had seen this in both human and rabbits' eyes.

Mr. M. S. Mayou said that one of the best methods of fixing eyes for examination of the vitreous and for the occurrence of any albuminous exudate was by boiling. The eye to be examined was put into water or saline solution at a temperature near the boiling-point, and then it was brought to the boil. By that means the tissues were fixed almost instantly, and so there was a reproduction of the natural condition on removal, and far more even and less flocculent fixation is obtained than by Zenker's fluid.

Dr. G. Mackay, referring to Mr. George Young's remarks, said trephining the sclera was performed many years ago by the late Dr. Argyll-Robertson and by himself, and their results were not satisfactory in securing a permanent lowering of the tension when the trephine was applied at what they then regarded as the safest position for it, namely, well behind the ciliary body. Mr. Young stated that his method was to apply it over the ciliary body. If he went through the ciliary body, as presumably he must so as to relieve the tension, he interfered, possibly, with the functions of that gland, and in that way might lessen the amount of its secreting surface. In regard to what Sir George Berry had said, the explanation which he considered satisfactory in regard to the lowering of tension which so frequently occurred in interstitial kera-

titis was that the very inflammatory process itself (which was not primarily in the cornea, but in the ciliary body), interfered so far with the function of secretion from that body that there was a lessened flow of aqueous into the eyeball.

The PRESIDENT, in replying to Col. Elliot, said he certainly thought his experiments bore out the suggestion which Mr. Priestley Smith made—that the anterior part of the ciliary body supplied most of the normal aqueous humour, and the posterior part of the ciliary body supplied the nutrient fluid of the vitreous humour. With regard to Sir George Berry's remarks, he would very much like to know what was the effect on the eye of a gradually lowered tension; he considered there was yet much to be learned about minus tension in the eye. In reply to Capt. Henderson, he said the eyes were placed in the Zenker's solution immediately after they were removed. In order that the conclusions drawn should be satisfactory he did a check experiment; he took the eyes of a rabbit, which had been killed without having had any operation performed on them, and hardened these in Zenker's solution in precisely the same way as the others; in these eyes there was no albuminous exudate found.

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2. *The histology of the trephined disc in glaucoma operations.*

By R. H. ELLIOT.

(With Plates VI—IX.)

THE gap left in the sclera or corneo-sclera after trephining operations for glaucoma has been studied in man by Holth (1), Verhoeff (2), Greeves (3), and the writer (4). Experimental studies on trephined eyes have been made in animals by Ducamp (5), Barraquer (6), Clausen (7), and Ellett (8). C. H. Reinhold (9) and W. C. Gray (10) have

carried out similar work, which has led to the adoption of conclusions identical with those arrived at by the four writers above named, but they have not thought it worth while to publish their findings. It will be observed that all this valuable and instructive mass of research work has confined itself strictly to the hole made in the eye-ball by the trephine, and to the subsequent behaviour of the edges of that aperture, whilst the condition of the disc removed to form the filtering channel has hitherto apparently received no attention whatever. For some years past the writer has, from time to time, had discs removed after trephining sectioned for examination, and, in the absence of any other published report on the subject, he thinks they may present features of sufficient interest to justify a short record of the work.

On clinical grounds, the writer has from the first (11) insisted on the importance of removing the whole thickness of the trephined disc, and has recommended the use of a special pair of forceps to facilitate the removal of any portion of the deeper layer which might accidentally be left behind, owing to the trephine having failed to cut through the tunic of the eye with sufficient completeness. Treacher Collins (12) has given a more precise significance to this clinical recommendation, as the result of his pathological findings, and has insisted on "the establishment of a permanent gap in the endothelium of Descemet's membrane" as "the most essential feature in the operation" introduced by the writer. "He says: "In a perforating wound of the eye the restoration of the continuity of the endothelium of Descemet's membrane may be impeded in various ways, under which circumstances the filtration of the aqueous humour through it is prolonged or rendered permanent." He goes on to mention the three ways in which this permanence may be brought about, two of which we shall quote: "(1) The inclusion of a fold of iris . . . between the posterior lips of a wound, interferes with extension across it of the endothelium. (3) The gap, formed in the tissue at the seat of the

wound, may be so wide that the endothelium is unable to extend across it. The latter is what probably occurs in the operation of sclero-corneal trephining, which renders it so eminently successful. A piece of the whole thickness of the sclero-corneal tissue at the limbus . . . is removed, and the possibility of the endothelium being able to extend round the whole of the inner surface of such a gap is exceedingly unlikely."

It is of interest in this connection to recall Ducamp's (5) observations on the failure of the trephine hole to remain permanent in his experiments on cats. He specially notes that in these operations Descemet's membrane was simply incised and not excised, even when the performance of an iridectomy, made *à ciel ouvert*, proved that the anterior chamber had been perforated by the trephine, and he concluded that the leaving behind of Descemet's membrane was an important factor in the healing of his corneo-scleral wounds in cats, and of those of others in human subjects. It is well known now that trephining experiments conducted on animals are inconclusive and unsatisfactory, and possibly an element in this may be a difficulty in effecting the complete removal of Descemet's membrane in them. As will presently appear, the same difficulty does not hold in operations on man, in whom, granted a proper technique, the whole thickness of the tunic can be easily and certainly removed in the great majority of cases.

This point is well illustrated by Figs. 1, 2, and 3, which present photographs taken from the writer's examination of an eye in which a successful trephine operation had been performed two and a half years earlier. The first figure gives a general view of the fistulous track established, whilst the other two, under a higher power, show the membrane of Descemet cut short at the opposite ends of the wound. It will be observed that on the scleral side of the opening that membrane is cut just internal to the point where it breaks up to form the pectinate ligament. Attention is also invited to the irregular hyaline thickenings on its deep surface.

A number of trephined discs have been sectioned and stained in various ways. In all such the membrane of Descemet, or this membrane and its continuation, the pectinate ligament, can uniformly be demonstrated forming a lining of the deep surface of the disc, always provided that a sufficient number of sections are examined, and that the technique has been correctly carried out. A good deal appears to depend on the method of cutting employed, and probably on the sharpness of the microtome blade and on the direction in which the cut is made (*i. e.* whether it presses the membrane up against the mass of the section or tears it away from it). On examining serial sections on a slide, it may be found that the membrane of Descemet is wanting in some of them, whilst it lies in its normal position in others, and in yet others is distinctly separated from, but lies close to, the cornea. The proportion varies in different specimens. A part of the explanation is furnished by those sections in which the membrane is found detached from the cornea and lying at a short distance from it (Fig. 4), for it will be readily understood that if the cutting blade passes through the cornea from within outwards, detachment of the membrane is unlikely, whilst if it passes in the opposite direction its occurrence is probable, since, in the latter case, the loosely attached membrane is pushed away from its bed and not towards it, as it must be in the former instance.

This is, however, only a part of the explanation. A more important factor would appear to lie in the direction in which the disc is cut. This is best explained by reference to the diagram shown in Fig. 5, which represents a trephined disc, on which the line *ab* shows the direction of a meridional or antero-posterior section, whilst *cd*, at right angles to this, is practically concentric with the edge of the cornea. Now, if the cornea has been split over a breadth of 1 mm., the light area (*cad*) is sclerotic tissue and the dark area (*cbd*) is corneal tissue. The examination of a number of sections has shown that a complete 2 mm. disc, cut according to the author's

PLATE VI.

Illustrates Lt.-Col. R. H. Elliot's paper on The Histology of the Trephined Disc in Glaucoma Operations (p. 227).

Fig. 1.—A meridional section through a filtering scar; the eye had been trephined two and a half years earlier. See also figs. 2 and 3 which show the two sides of the fistula under a higher power.

Fig. 2.—The right-hand wall of the fistula shown in fig. 1. M, the cut end of the membrane of Descemet.

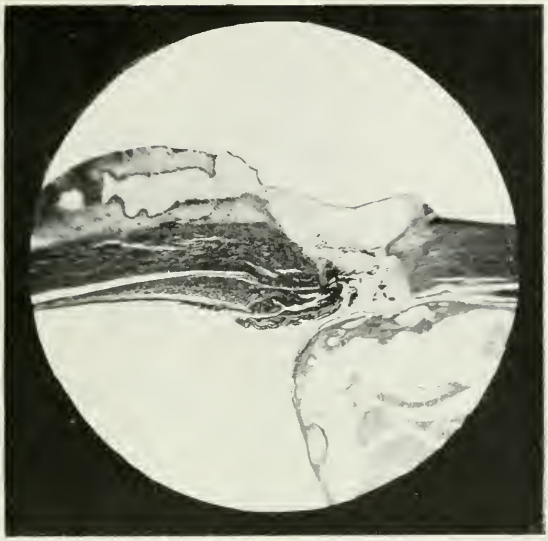

Fig. 1.

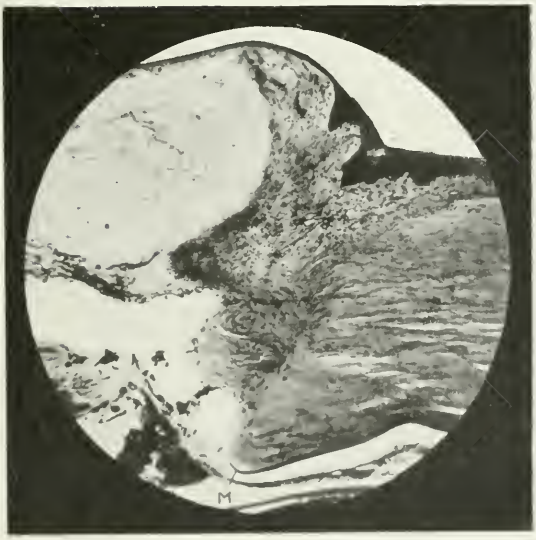

Fig. 2.

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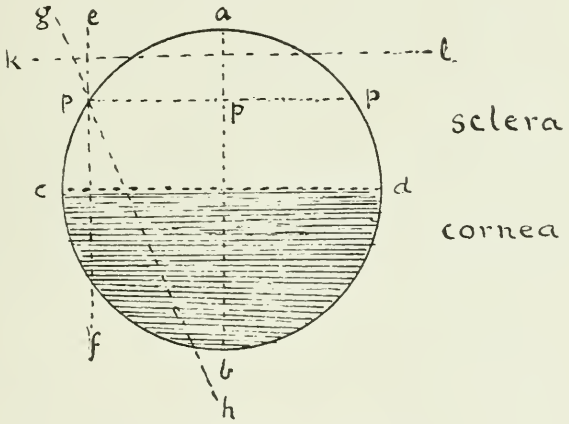
method, usually includes an appreciable part of the pectinate ligament, represented on the diagram as *appp*. It is obvious that all sections in front of *pp* and parallel to that line, will include the membrane of Descemet throughout their extent and will not impinge on the pectinate ligament. Similarly, any section parallel to *ab*, such as *ef*, or any section passing obliquely, such as *gh* (neither of which impinges on the area of the pectinate ligament) will be lined throughout its extent by Descemet's membrane alone.

TEXT-FIG. 53.



(This is the Fig. 5 mentioned in the paper.)

From the examination of a number of sections, it is clear that the pectinate ligament and that portion of Descemet's membrane close to it, is much more firmly adherent to the subjacent layers of the cornea than is the same membrane further inward (*i. e.* further on to the cornea). This looseness of attachment between the membrane and the cornea is well illustrated in a number of our specimens. Other sections serve to explain how a surgeon may flatter himself that he has avoided the pectinate ligament with his trephine, when in reality he has failed to do so. Our work also shows how necessary it is that in sectioning these specimens, the technique should be as careful and perfect as

possible. Before cutting the disc one must ascertain which is the meridional plane of the globe by noting the differences in colour between the scleral and corneal portions of the disc; one must then be careful to imbed the specimen in such a way as to ensure its being sectioned in the correct (meridional) plane. This is far from being as easy as it sounds; indeed, unless considerable care be taken, the small piece of tissue may be cut so obliquely as to miss its deep surface altogether; this is the more readily done, if only half the disc has been removed. The false impression may thus be gained that the membrane of Descemet has not been removed, when it really has been so. For all practical purposes the question, whether the whole thickness of the ocular tunic has been removed or not, can be settled by transferring the disc to a watch-glass of normal saline solution, and examining it with a corneal loupe. The shiny surface of Descemet's membrane can easily be distinguished, and usually some deposits of iris pigment will be clearly seen on it, especially if the disc and iris have been seized in one grip of the forceps for the purpose of the removal.

Another very puzzling condition may easily be met when there has been an error in orienting the specimen before sectioning it, viz. that the area of the disc lined by Descemet's membrane may be missed altogether and the pectinate ligament may then alone be represented in the depth of the specimen. Such would be the case in the event of a section made along the plane of the line *kl* in Fig. 5. At first sight, the elements of the ligament may then easily be mistaken for those of the deeper corneal layers; a comparison of the thickness of the individual fibres of the tissue will speedily settle this question, for the pectinate fibres are decidedly finer than the corneal.

Some stress has been laid by writers on the importance of applying the trephine in such a position that the disc excised shall be lined wholly by Descemet's membrane to the exclusion of the pectinate ligament, and this has been made an argument for the use of smaller trephines than

those advocated by the writer. On this subject Treacher Collins (12) writes: "Elliot has frequently laid stress on the importance of making the trephine hole well forwards. . . . It is, I suggest, always desirable that the piece removed should include a complete disc of Descemet's membrane and not encroach on the ligamentum pectinatum, which in many cases of glaucoma has the root of the iris in immediate contact with it. I have found experimentally that the line of junction between clear cornea and opaque sclerotic on the surface of the globe is 1 mm. internal to the position where Descemet's membrane commences to split up into the fibres of the ligamentum pectinatum. If, therefore, a 1·5 mm. trephine is used, and the centre of it is placed over the margin of the cornea on the surface of the globe, a complete disc of Descemet's membrane will be found on the posterior surface of the piece excised." It is pertinent here to mention Greeves' work on this subject. He has shown that to trephine far out is hazardous, inasmuch as it involves a risk of the implication of the ciliary processes in the trephine hole, and he has suggested that the sudden bulging of the ciliary body into the wound may suffice to rupture the zonule of fibres in the neighbourhood, and so to allow a prolapse of the ciliary processes.

The writer has found that it is easy to split the cornea over a distance of 1 mm. in the great majority of cases. Using a 2 mm. trephine, this technique should just enable the operator to cut through Descemet's membrane all round his disc, assuming Collins' measurements to be correct. The latter does not, however, specify in what meridian of the eye his measurements were made; this point is not unimportant, for Rochon-Duvigneaud (13) has shown that the interval between the transparent edge of the cornea on the one hand and the angle of the chamber on the other varies considerably according to the direction in which the measurement is made; thus, above the cornea in the vertical axis, the average is 2·5 mm. below the cornea 2 mm., and to the nasal or temporal side, in the horizontal

axis, 1·25 mm. The writer controlled these measurements on eyes in Madras, and found that the averages were slightly lower than those arrived at by the French worker. This was probably to be expected, as the Southern Indian is on the average a smaller and lighter man than the European.

For the moment we may leave the theoretical method of approaching the question on one side and deal with certain facts, which stand out clearly from the examination of a number of trephined discs. These are as follows:

(1) It is not only possible, but it is even easy with a trephine to cut out a portion of disc, which, in the anterior part of its circumference, shall include Descemet's membrane, and in the posterior part the whole thickness of the pectinate ligament.

(2) The deep surface of the disc (*a*) may be lined throughout by Descemet's membrane (see Figs. 1 to 3 and also Fig. 4), or (*b*) it may be lined partly by Descemet's membrane and partly by pectinate ligament (Figs. 6 and 7), the relative amounts of the two varying according as the trephine has been placed more or less far forward on the corneo-sclera. Both these conditions can be freely illustrated from our specimens. There is a third contingency, which is, however, on a somewhat different plane, viz. that the deep lining of the whole of a disc section may consist of pectinate ligament to the total exclusion of Descemet's membrane. It is important to understand aright the significance of such an occurrence. After a well-performed trephining it simply means that the disc has not been properly oriented for sectioning and that a sufficient number of sections has not been examined to catch that through the middle of the disc. Should these precautions have been taken, and the disc be still found to be lined exclusively by the ligament, the inference is, that the trephining has been done too far out, and at the same time that a small trephine blade has been used, or else that the outer half of the disc has alone been excised.

PLATE VII.

Illustrates Lt.-Col. R. H. Elliot's paper on The Histology of the Trephined Disc in Glaucoma Operations (p. 227).

Fig. 6.—Disc partly lined by Descemet's membrane and partly by pectinate ligament (Mrs. J —).

Fig. 8.—Trephined disc and prolapsed iris cut away together.

Fig. 9.—8 under a still higher power, to show excrescence on Descemet's membrane.

Fig. 13. —A trephined disc, showing the membrane of Descemet on its lower surface To the left of the photograph this membrane is breaking up to form the pectinate ligament.

Fig. 6.

Fig. 8.

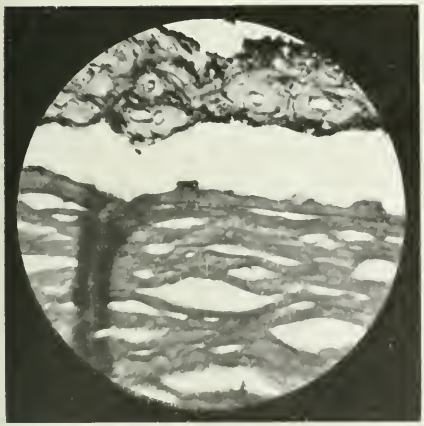


Fig. 9.

Fig. 13.

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PLATE VIII.

Illustrates Lt.-Col. R. H. Elliot's paper on The Histology of the Trephined Disc in Glaucoma Operations (p. 227).

Fig. 3.—The left-hand wall of the fistula shown in fig. 1. The membrane of Descemet can be clearly seen cut across. On tracing it to the left, hyaline excrescences are seen on its surface; further still to the left it breaks up to form the pectinate ligament.

Fig. 4.—A trephined disc, with Descemet's membrane and the knuckle of prolapsed iris, all removed with one snip of the scissors at the time of operation.

Fig. 7.—A trephined disc lined on its deep surface by a small portion of Descemet's membrane, which proceeds to split up into the pectinate ligament when traced to the right of the photo. The knuckle of iris can also be seen below this in the figure.

Fig. 3.

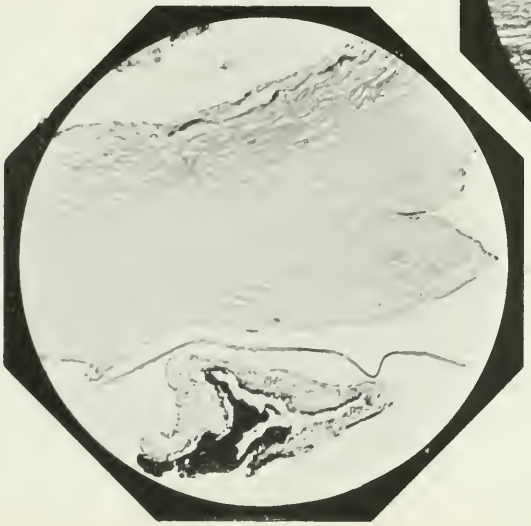

Fig. 4.

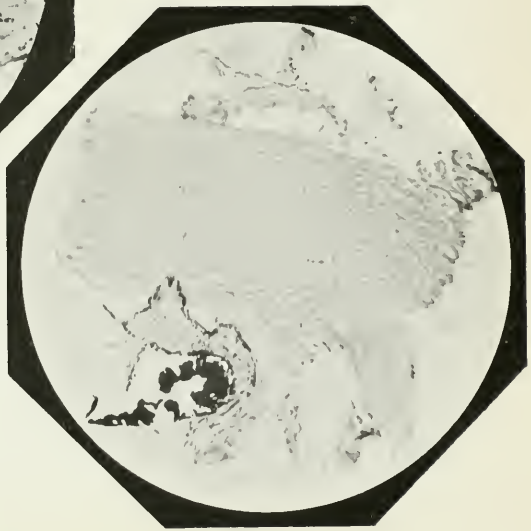

Fig. 7.

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(3) Always provided that the opening made by the trephine does not become blocked by uveal tissue, or by inflammatory exudate from that tissue, satisfactory filtration may be certainly established when a part, and even a fairly large part, of the lining of the disc consists of the fibres of the pectinate ligament. This has been shown by the examination of discs of this nature, which have been obtained from eyes in which trephining has proved a perfect success (Figs. 6 and 7).

Moreover, we know that a trephining performed far out may, and often does, yield the most excellent results. This has not only been illustrated in many instances in which the writer's operation has been defectively performed, but it is the procedure advocated as a routine matter by Freeland Fergus (14), who places his trephine immediately behind the limbus, uses a 3 mm. blade, and deliberately lays bare the ciliary body. It is these matters that constitute the radical difference between the Fergus operation and that of the writer. Judging from the results obtained when examining discs from the writer's operation, one may fairly deduce that those yielded by the Fergus procedure would be lined, so far as they lie in front of the angle of the chamber, exclusively, or almost exclusively, by pectinate ligament. The writer has from the first thought and said that trephining so far back is a mistake, but it would be unscientific and futile to deny that good results and admirable filtration are frequently obtained by this method.

It has sometimes been argued, presumably on theoretical grounds, that it is a difficult thing to remove the whole thickness of the pectinate ligament on the deep surface of the disc by using a trephine. We have shown conclusively, and can prove it by a considerable number of sectioned discs, that the suggested difficulty is only an imaginary one, but even should the deepest layers of this structure be left behind, owing to faulty trephining, it may fairly be argued that such a defect in technique would be far less important than that of leaving behind

a portion of Descemet's membrane ; for, whilst the latter is impervious to fluid, we know that the meshes of the former transmit it readily.

The real objection to trephining far out is that which has already been indicated, viz. the danger of prolapse of uveal tissue into the wound. The writer has from the first insisted on this from the clinical point of view, and Collins and Greeves have supplied the necessary pathological evidence, as has already been shown It is not merely that the adhesion of the iris base to the cornea makes it practically impossible to avoid the former structure in many cases ; for another element enters into the problem, viz. the consequent dragging forward of the ciliary body with its processes. This brings us to another important anatomical point, for in some of our specimens it has been seen that the iris tissue is tightly adherent to the deep surface of the disc over a greater or less extent of its peripheral circumference. When the trephine blade cuts through such a disc, the anterior part of the opening made is into the anterior chamber, and the peripheral iridectomy, which is performed by seizing the disc and iris in one grasp of the forceps, involves free iris over a corresponding area, whilst the posterior part of the opening goes direct into the posterior division of the aqueous chamber, and removes the whole thickness of the disc (including the pectinate ligament) and the subjacent adherent iris in one block. Clinically, such a procedure may usually be relied upon to produce a good filtering scar.

Allusion has been made to Ducamp's observation that the failure to obtain a good result in cats was due to the membrane of Descemet being left behind, even when an iridectomy had been performed. At one time there was a disposition to argue that because trephining failed in animals, it must necessarily be equally unsuccessful in man. Time and experience have shown the fallacy of such a deduction, but considerable interest centres round the explanation of the discrepancy between the human and animal results. It is, of course, possible that the mem-

brane of Descemet has a greater tendency to repair breaches in its surface in cats and rabbits than it has in man. Again, it is not impossible that faulty technique, and especially the use of blunt trephines, may have been responsible for the failures recorded. The true explanation is, however, probably to be found in Collins' work on the "Anatomy of the Ligamentum Pectinatum" (15), in which he showed that the angle of the anterior chamber comes far further forward in animals than it does in man; this is associated with a corresponding advance in the position of the ciliary body and its processes. At the same time, it must be remembered that it is practically impossible to split the cornea of an animal, although the procedure is quite an easy one in the human eye. Our trephine wound in animals is thus forced far backwards, whilst the angle of the chamber and the site of the ciliary body are both advanced relatively to what is found in man; this combination makes a successful trephining difficult, if not impossible, in the eyes of sheep, cats, rabbits, etc.

The object aimed at in sclero-corneal trephining, has from the first been to effect an entry directly into the anterior chamber, and so to drain the eye from the reservoir of fluid in that cavity. When the trephine cuts out a neat disc, the moment it is withdrawn, the latter is pushed up by a dark bead of prolapsing iris. If the surgeon seizes the disc and the bead of iris in one grip of the forceps, and cuts them off with a single snip of the scissors, he gains two distinct advantages: (1) The patient cannot move the eye away, and thus cause the iris to be drawn into the wound by the hold on the forceps, and (2) it is obvious that *the membrane of Descemet and its expansion into the pectinate ligament must be excised as widely as the limits of the removed disc.* This is shown in Fig. 8, in which it is seen that the excised knuckle of iris still remained attached to the deep surface of the disc, thus enabling the two to be cut in one block. The commoner occurrence is for the knuckle of iris to float away from the disc as soon as the two are placed in the formalin.

solution. It must, we think, be obvious that when the iris and disc are removed together there is a moral certainty of the inclusion of the deepest layers of the cornea in the removed disc. Other illustrations of the same thing are to be found in Figs. 4, 6, and 7.

Should the surgeon fail to cut through the disc round a sufficient area of its circumference, he will see a thin, milky-looking membrane blocking the bottom of his trephine-hole after he has exercised the disc. A histologic examination of the part removed will show that the membrane of Descemet has been left behind. It is sometimes a very difficult matter to excise the deep layer when so left. The writer has advocated for the purpose a pair of forceps with backwardly projecting teeth, which are often of considerable service. Even with the use of these, great difficulty may be encountered. If this deep layer is left behind, the operation will probably end in failure. It is, therefore, much better to re-introduce the trephine and to complete the removal of the disc therewith, even if some aqueous has escaped. The comparatively thick pad of iris makes the danger of doing so very small, but it is likely that more pain will be inflicted than if the ordinary smooth course of cutting out the disc had been effected in the first instance.

The writer still advocates the technique of directing the trephine at such an angle that its blade first finds its way through on the corneal margin of the disc. In so doing, his object is, not to cut through Descemet's membrane rather than the pectinate ligament—for that point does not seem very important—but rather to ensure that the fistula through the tunic of the eye shall be placed as far as possible from the ciliary body and from the base of the iris; in other words, his examination of removed discs has only served to strengthen the view that he has held from the first—that the object of getting far forward is to avoid the impaction of uveal tissue in the wound, and so to secure the attainment of what he regards as the glaucoma surgeon's ideal, viz. the iris-free scar.

PLATE IX.

Illustrates Lt.-Col. R. H. Elliot's paper on The Histology of the Trephined Disc in Glaucoma Operations (p. 227).

Fig. 10. – Excrescence from fig. 11 under high power.

Fig. 11.—Shows the splitting up of Descemet's membrane to form a part at least of the meshwork of the pectinate ligament.

Fig. 12.—Shows the same thing as fig. 11; it is taken from a different specimen.

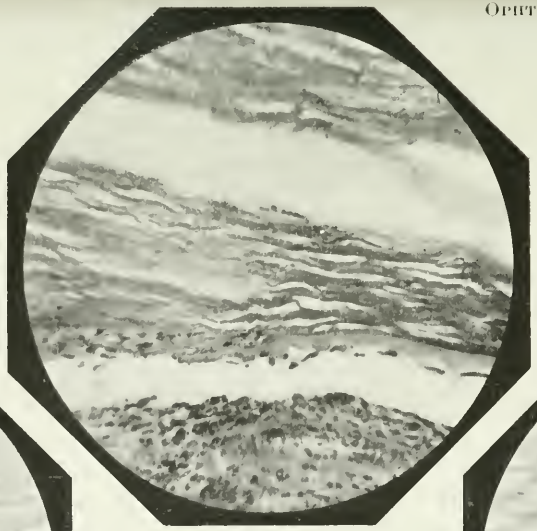

Fig. 10.

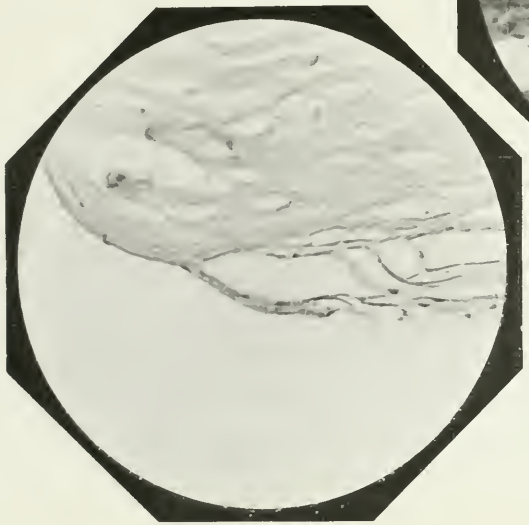

Fig. 12.

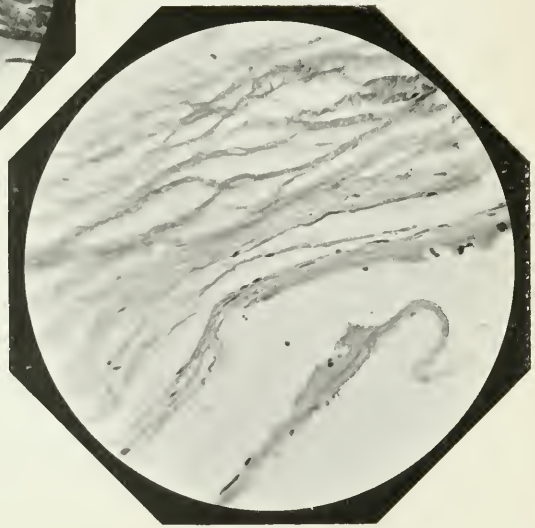

Fig. 11.

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Hyaline Thickenings on Descemet's Membrane.

In the course of examining a number of discs, one interesting feature has presented itself uniformly in the specimens taken from cases of senile glaucoma—viz. the presence of hyaline thickenings on the posterior surface of Descemet's membrane (Figs. 8 and 9). These are especially abundant in that zone of the membrane which lies immediately internal (corneal) to the line at which the breaking up of the membrane to form the pectinate ligament takes place, and have never been found far away from that area. They are very irregular in shape, and appear to be scattered erratically in a haphazard manner on the membrane; some of them are covered with adherent uveal pigment, probably due to the accident of adhesion of the iris base to the periphery of the cornea. Struck by the extraordinary constancy with which this phenomenon is met with in his collection of discs, the writer examined a number of sections of glaucomatous eyes, and again found the hyaline excrescences with great frequency (Fig. 10). At least two possible explanations present themselves to start with: (1) That such excrescences may be the rule in elderly people of the glaucoma age; and (2) that there may be some definite connection between them and the presence of glaucoma. Most of the authorities are quite silent on the subject of such excrescences, but Salzmann (16) mentions them and states that the frequency of their occurrence increases with the age of the patient. It would be of interest if some pathologist who possesses the necessary material would examine a large number of the eyes of elderly people in whom no suspicion of glaucoma exists, and would thus ascertain the relative frequency of occurrence of the phenomenon in normal subjects. Henderson (17) has maintained that there is a progressive thickening of the fibres of the pectinate ligament, which occurs as life advances and which is due to a definite act of secretion on the part of the cells, which constitute the

whole of this structure at birth. He has suggested that the blocking up of the filtering spaces of the ligament, which results from this thickening of its fibres, determines the onset of glaucoma. His main contention as to the thickening of the fibres does not appear to have been either confirmed or refuted by any other observer, but certain points which are not without interest appear to emerge from the present investigation: (1) The hyaline thickening of Descemet's membrane occurs only on the surface which is lined by endothelial cells; this is in accordance with Henderson's suggestion, and it also supports Collins' (18) view that "the elastic lamina itself is originally developed from the endothelial cells which line its posterior surface. (2) The thickenings met with occur over a narrow area—viz. that which is most likely to be influenced by changes in the vascular condition of the parts. (3) No evidence of irregular hyaline thickening of the fibres of the pectinate ligament has been discovered, though a very large number of specimens have been examined. (4) There has also been a total absence of any evidence that the spaces normally occurring in the pectinate ligament are really blocked up by the increased mass of the fibres; on the contrary, these spaces are always found wide open, unless as a result of pressure from within in late cases. Under these latter circumstances the spaces are indeed closed, but obviously as the result of the pressure referred to, for the area occupied by the ligament is then greatly diminished, and the inward bulge that has accompanied the compression can be clearly seen on the inner surface of the sclera.

It is with some diffidence that attention has been drawn to these hyaline excrescences, as it is obviously difficult to form a definite opinion as to their importance. It hardly seems likely that they have any ætiological significance. If further investigation should prove that they are more commonly met with in the glaucomatous than in normal subjects of the same age, the presumption that will arise will probably be that they are a result and not a cause of

those pathological processes which attend a rise of tension in the eye. If one might hazard a guess, it would be that possibly they are due to the long-continued congestion, which, in a greater or less degree, is probably inseparable from the glaucomatous condition.

These considerations lead one to make a few observations on another subject—viz. the nature of the pectinate ligament.

The Nature of the Ligamentum Pectinatum.

There is a considerable difference of opinion on this subject. The classical teaching is that the ligamentum pectinatum is formed by the breaking up of Descemet's membrane into a leash of fibres, and that the spaces within this mesh-work are lined by extensions from the layer of endothelial cells which covers the posterior surface of the membrane. This view has been accepted by most writers on the subject, including Parsons (19), Schäfer (20), and Collins, and it has recently been restated as the result of a very careful anatomical research by Prof. Arthur Thomson (21).

On the other hand, T. Henderson (17) depicts Descemet's membrane as ending abruptly to the inner side of the ligament; he states that "the corneal lamellæ, next to Descemet's membrane, break up into the innermost fibres of the cribriform ligament at a point just anterior to the termination of the membrane." He believes that the origin of the ligament can be best made out in specimens stained with van Gieson; for, "as Descemet's membrane does not stain the same rich red colour as connective tissue, it stands out under such circumstances quite apart and distinct from the ligament, whose sclerosed fibres are thus easily traced as a direct continuation of the inner corneal lamellæ." More recently, L. Buchanan (22) has supported Henderson, having satisfied himself that Descemet's membrane ends rather abruptly at some little distance from the angle of the chamber. He believes that it plays no part in the

formation of the pectinate ligament. Salzmann (16), too, takes a somewhat similar view, and describes the boundary between the membrane and the ligament as sometimes abrupt and sometimes sloping; he is careful to say that the membrane does not really stop abruptly, but is continued over the trabeculæ of the iris angle as a very thin layer; "the appearance of an ending is," he says, "only brought about by the fact that the membrane thins out so suddenly."

In the course of the present investigation a very large number of sections of trephined discs have been examined, and in most of these the area of junction between Descemet's membrane and the pectinate ligament was demonstrated. Great care was taken to ensure the sections being cut meridionally to the eye, and a variety of stains, including van Gieson's, Weigert's iron-hæmatoxalin, and orcein, were employed. The specimens were cut and prepared by Mr. Chesterman, of Oxford, to whom the writer is much indebted for the great pains and skill he has lavished on them. In no single instance has it been found possible to show an abrupt ending of the membrane of Descemet, whilst in a large number that structure can be clearly seen breaking up into a leash of fibres, just as described by Thomson and others (Figs. 11–13). The difficulties of settling histological questions of such a nature are well known, and the pitfalls are many, but one could hardly rise from the examination of any considerable number of these specimens with any serious doubt in one's mind that the pectinate ligament is formed, to some extent at least, by the breaking up of Descemet's membrane. At the same time many of the sections suggest that the deepest lamellæ of the cornea proper take a part in the enclosing of the spaces of the pectinate ligament. In other words, those spaces seem to lie partly in the meshes of the broken-up membrane of Descemet, and partly in those of the deepest strata of the substantia propria of the cornea. Just where the membrane begins to break up, one can see in a number of the specimens fine fibrils which pass between

it and the deepest corneal lamellæ, serving to bind the two together; this explains why, in some of the sections, we find the membrane of Descemet wholly detached and separate from the rest of the disc, but firmly fixed to it at its outer extremity.

This anatomical discussion is obviously an aside which is only slightly connected with the original object of the research, but chance has thrown it in our way, and opportunity has brought it into prominence. The writer holds no brief for either theory, but he is the more anxious to get at the truth, because it seems possible that the knowledge so obtained may have a clinical bearing. It has, therefore, been thought advisable to allude to the appearances observed, in the hope that doing so may serve again to draw attention to what is still undoubtedly a disputed point.

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Capt. Thomson Henderson said this was a subject on which he could say a great deal, but he must forbear entering into detail. Still, he would like to aver his belief in regard to Descemet's membrane. He regarded Descemet's membrane as a deposit due to the activity of the epithelium lining the anterior chamber. That

was why in the fœtal eye, or in the eye of a young animal, Descemet's membrane was most inconspicuous. The older the eye, the more marked did Descemet's membrane become. In the senile eye, whether of man or beast, this membrane was singularly well marked, especially towards the circumference of the anterior chamber, where excrescences were constantly to be seen in senile eyes. He had often observed the same irregularities in the eyes of horses fifteen years old, and in old cows which he had examined. When one saw a structure exhibiting such a marked progression of growth, it supported that idea. He would also reaffirm that the pectinate ligament did not in any way arise from Descemet's membrane. The so-called pectinate ligament arose from the inner lamella of the cornea. From its nature and its retiform structure he had been induced to give it the name "cribriform ligament," which, arising from the inner lamella of the cornea, had, he contended, nothing to do in origin with Descemet's membrane. In the histology of this cribriform ligament one again saw the same progression. In the fœtal eye it was a cellular structure, and then one could see it, at different ages, passing through various stages until it became fibrous, and it was this fibrous structure which, he believed, formed the anatomical basis of glaucoma.

The PRESIDENT considered this paper a very interesting one. The anatomical basis of operations for the production of permanent filtering scars was a most important matter. He considered that the evidence which Col. Elliot had supplied to the Society in this paper added very much to the previous knowledge on the subject. There had now been examined sections of trephining operation scars which had succeeded. There was one reported by Dr. Verhoeff, and the one which Col. Elliot had now shown. There had also been descriptions of trephining operation scars where the operation had failed in a paper read before the Society on a former occasion by Mr. Greeves. It was necessary to have a

sound anatomical basis before we were in a position to understand the essential principles of the physiology of filtration cicatrices. The external tunic of the eye had been trephined in various positions. The first site at which the operation was performed was the centre of the cornea. Sir William Bowman trephined it for the condition of conical cornea, but this did not result in the production of a filtering scar. Bowman was pleased with the fact that the opening filled up in a fortnight. Epithelium probably extended down from the surface and formed a plug externally. In many of the cases the iris became entangled and closed the opening posteriorly. Argyll-Robertson trephined the sclera over the posterior part of the ciliary body, but these openings filled up; the parts were not kept bathed constantly by aqueous humour, and there was not the desired reduction of tension. Freeland Fergus trephined external to the pectinate ligament, doing at the same time a cyclo-dialysis. At the time that gentleman read his paper at Belfast, he (Mr. Collins) suggested that the success of the operation was due more to the cyclo-dialysis than to the trephining. He (the speaker) had had the opportunity of examining an eye anatomically which was trephined external to the ligament, and there the wound had cicatrised firmly up. There was no filtering scar; its lips had not been kept bathed by aqueous. He considered that there was only one zone in the circumference of the eye in which it was possible to secure a true filtering scar, and that was the zone which Col. Elliot had hit upon at the sclero-corneal margin. By trephining there a circular piece of Descemet's membrane and its lining endothelium could be removed with or without a small piece of the pectinate ligament, and the gap so produced did not fill up, and the wound did not heal if it were kept aseptic. The endothelium did not extend across the gap and the lips of the wound were kept bathed by aqueous; a perfect fistula was thus formed. If the incision went a little further back, only through the pectinate ligament, there was a danger, such

as Mr. Greeves pointed out, of prolapse of the ciliary body, which filled up the posterior surface of the wound. Greeves showed that this was what occurred in the cases which he had examined in which the operation had failed. The operator must keep well forward, as Col. Elliot had insisted on, and should aim at getting a complete circle of Descemet's membrane.

Capt. R. R. Cruise, referring to the President's remarks, said he would like to mention briefly a point from his own experience. He had ample proof that it was not necessary to excise a circular piece of Descemet's membrane in order to secure a permanent filtration scar. He admitted that the theory of it was attractive, but for the past three or four years he had retired from the operation of trephining for glaucoma. He obtained much more satisfactory results from a modification of Col. Herbert's sclerotomy flaps, in which there was incision, but no excision of Descemet's membrane. He had notes of cases operated upon by this method which had gone on satisfactorily for five to seven years. During the time he had been performing the operation there had been no material for making an anatomical investigation. He was still waiting for an opportunity of investigating by microscopical examination why the operation he had mentioned was successful. Only twice in seven years had he had to do the operation more than once in the same eye. He invariably kept the wound open for about a week by massage, and he could only theorise as to why the cases remained open. He felt convinced it was not a question of excision of Descemet's membrane, nor of the continuous contact with and bathing in the aqueous humour, which kept the wound from healing. Frequently in cases of cataract operation with a large conjunctival flap, the cut margins of the flap became adherent before the corneo-scleral wound healed. In these cases the anterior chamber continued up under the conjunctival flap, and if the absence of healing were because of contact with aqueous humour, there was no reason

why the corneo-scleral portion should ever heal. Some of these flap sclerotomy cases appeared to seal up at first, but they subsequently filtered properly on massage. His theory was that by repeatedly opening up the wound by firm massage one really engaged in a race between the connective-tissue cells and the endothelial cells; if the endothelial won, there was an endothelial lining to the cuts, and permanent fistulisation took place. Once a fistulous scar was produced it was not a localised lump, but a diffuse bogginess, and under those circumstances one got a complete and permanent reduction of tension.

Mr. Stroud Hosford said he agreed with what Mr. Cruise had just said. He was astonished that Col. Elliot had had the opportunity of examining so many eyes. He had seen recently cases of glaucoma in which the eye had been lost after trephining. For eight years Mr. Brooksbank James and he had been doing a modified Lagrange operation, in which a piece of corneo-scleral tissue was turned out under a conjunctival flap and an iridectomy performed at the same time. And so far, except for the blind eyes on which they had experimented, and secondary cases, they had lost none. In a certain percentage of the cases there had been a rapid closing up of the cicatrix, and on those they had to perform a sclerotomy a second time. In that sense the first procedure was not a success, and a second operation was necessary, and successful. From 60 per cent. to 70 per cent. of the cases, however, filtrated after the first operation and remained permanently filtrating; but during the last two years that percentage had risen to 90. No eyes had been lost or had to be excised after operation, excepting for cases which were septic in origin before operation, and therefore of a secondary glaucomatous nature.

Lieut.-Col. Elliot, in reply, said he was much interested in what Capt. Henderson said, and he would like to see some of the stained specimens on which that gentleman founded his view. He did not pretend to pit his knowledge on the subject against Capt. Henderson's, but the

matter had been forced upon his attention by the large number of cases in which he had an opportunity of examining the junction of the pectinate ligament with Descemet's membrane. In none of the specimens—and the President knew how numerous the specimens had been —had he been able to find thickening of the pectinate ligament fibres such as would have caused obstruction to the flow of fluid through them. Where there had been obstruction in that locality it had been due to the whole of the pectinate ligament being blotted out by pressure from within; in these cases the fibres were pressed together in the way that blotting-paper would be after it had been pressed with an iron. There was not in any of the cases anything which would suggest thickening of individual fibres. He agreed with the remarks of the President. Sclerotomy had been on trial for a very long time now; Capt. Cruise had been fortunate in his experience of it. He (the speaker) had seen excellent results from it, but, to his mind, it did not ensure certainty of results such as were obtained when one took away a piece of Descemet's membrane. He wished to correct a misapprehension in Mr. Hosford's mind: he had not removed all the eyes from which he had shown discs; it was only the discs that had been removed.

XIII. MISCELLANEOUS.

1. *A further note on the visor.*

By R. R. Cruise.

It will be within the recollection of members who were present last year that, following upon my paper on "Protection of the Eyes in Warfare" and the demonstration of the visor at the 1917 Congress, a resolution was forwarded to the War Office in the following terms:

"The Ophthalmological Society of the United Kingdom, having examined the steel visor devised by Capt. Cruise, has good reason to believe that it would prevent at least 50 per cent. of all eye injuries received in warfare. . . .

"This Society respectfully begs to urge that the production of the visor should be expedited, and that its application and method of use should be placed under the supervision and control of a competent expert authority."

The War Office gave due consideration to this authoritative statement, and I have no hesitation in asserting that the visor took on a fresh lease of life as a direct result of the action taken by the members at the last meeting.

In June I received a letter stating that, owing to numerous complaints from units to whom the visor had been issued, it was not considered advisable to enforce its use, but that if I would investigate the subject in the field every facility would be afforded me.

I thereupon proceeded to that army which had had the greatest experience of the visor in warfare.

I toured the forward areas and discussed the question with the officers, N.C.Os. and men who had actually worn the visor in the front line, and acquired much valuable and practical information.

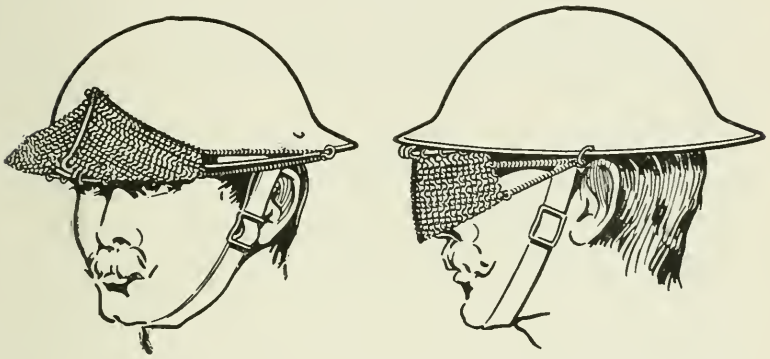
Its unpopularity was due to two reasons:

(1) Entire ignorance of the purport of the visor, emanating from a very natural ignorance of the causes of blindness in this war.

(2) Impracticability and faultiness of design. (The complaints under this heading were genuine and obvious, and I will briefly mention them.)

(*a*) The visor could not be *kept* taut before the eyes by the chains and hooks, and consequently

FIG. 54.



flopped about, rubbed the nose, and was inclined to make the wearer giddy.

(*b*) When thrown up, the ends of the chains rattled on the steel brim, and rendered silent patrol work impossible; also the arrangement of the fastening permitted the visor to sag over the edge of the brim unless fastened with great care.

(*c*) The hooks were projections on the surface of the steel hat, and very soon were broken off or flattened down.

(*d*) The chain-links readily tore off from their attachments to the mail in the course of ordinary rough usage.

These were faults in design, and remediable.

The principle of ocular protection was viewed in a

much more appreciative light when it was pointed out that a large proportion of blindness was caused by small particles, that it was preventable in character, and that an injury which would be considered trivial and negligible in any other part of the body produces total disablement of a calamitous nature if it involves both eyes.

I was requested to evolve another design which would overcome the difficulties.

After numerous attempts and many disappointments in a large workshop at the base, I finally produced the practical working model which I am showing you to-day. It overcomes all the objections hitherto adduced.

The mechanism is simplicity itself and fool-proof.

The essential features are the central strut and the side-springs.

The central strut keeps the chain mail away from even the most prominent of nasal organs, and acts as a fixed point on which the springs can pull, and keep the visor taut and motionless before the eyes.

Steel wires run from the central strut through the lowest rings of the chain mail, to be attached to the springs on either side of it, so that the tension of the springs is taken by the steel wires, and not by the links of the mail. At no period is there any strain on the comparatively speaking weak meshes of the chain mail.

The strut is so shaped that it can pivot freely round the margin of the brim, lying flat on its upper surface when the visor is not in use; when lowered for use, a stop acting on the under surface of the brim keeps the visor off the face.

The visor can be raised or lowered in a second by lightly pushing up or pulling down the free end of the central strut.

There are no chains to rattle, or hooks to break off.

Five hundred helmets with this pattern of visor were issued to troops, and in each helmet a printed circular was placed, briefly stating the purport of the visor, the

causes of blindness, and quoting the resolution of the Ophthalmological Society, as forwarded to the War Office.

In the early part of this year I toured the whole of our front line, and received the reports of those units to whom the visors had been issued for trial. Veracity compels me to admit that the great majority of opinions expressed to me personally were not only favourable, but enthusiastically so, to the universal adoption of the model as now designed.

G.H.Q. received the official reports, and have requested a further extended trial with two thousand more of the same pattern, and that is the position at the moment of writing.

In conclusion, I would like to state that a further twelve months' experience of war injuries has only served to strengthen my conviction as to the desirability of ocular protection against preventable blindness, and to support the figures I gave before as to the proportion of blindness that is preventable.

My recent experiences and discussions with officers and men in the field have convinced me personally that the new model visor is a practical protection for the eyes which does not militate against efficiency.

Experiments on the rifle range proved, rather to my surprise, that records made at the targets with the visor lowered were practically identical with those made with the visor raised—in fact, in bright sunshine, it seemed to be rather an advantage than an hindrance.

Its universal adoption would ensure economy in man-power and economy in pensions, while its humanitarian value ought not to be lightly weighed in the balance.

Capt. Stack asked if the gas helmet was a difficulty—whether there was any reason why there should not be a piece of the chain fastened to the gas helmet, instead of having it fixed to the cap.

Capt. Cruise (in reply) said he thought the celluloid

in the gas helmet would protect by keeping out a large proportion of the particles which caused blindness or eye injury in warfare. He did not advocate the lowering of the mesh for use when the gas helmet was being worn. But if the men were sitting down and being shelled, there seemed no reason why the visor should not be drawn over the eyes. The men's common sense would tell them when it would be of value. He endorsed Col. Lister's remarks concerning the ignorance displayed as to the causation of blindness, as well as to the apathy existing on the matter among the medical authorities. There was much more enthusiasm among the combatant branch when they had read the brief notes he had had placed inside the helmet. Many had asked where the visor could be obtained privately. The question of wear and tear in the rough handling likely to be given to it was important, but a compromise had to be effected between efficiency and lightness. This design seemed to him to be as effective a compromise as could be arrived at. There was no wear and tear on the meshes. Most of the time the mail chain was lying on top of the helmet. He agreed that the springs were liable to get out of order. Still, the visor was turned out wholesale, and if a spring got broken another could very soon be put in from stock. The chain portion was treated with a rust-proof process. He thought it might be practicable to have an eye-piece in the gas mask made of triplex glass instead of talc—or at least the substance which passed for triplex glass in the Army.

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2. *The dioptric mean in myopia, with special reference to military requirements.*

By W. Wallace.

The figures which I have the honour to submit are the result of an attempt to determine whether the amount of a soldier's myopia affords a clue to the extent of his

visual acuity, and, conversely, whether his alleged vision indicates approximately his myopia.

I am not aware of any investigation of this kind having been carried out among cases occurring in civil practice, but it is possible that an enumeration, somewhat on the lines which I am about to explain, may be of value when the extremely difficult question of military standards of vision is considered.

In the first instance, one thousand myopic eyes were chosen, as they happened to come in the records of a large ophthalmic centre under my charge. The period covered was from May, 1915, to May, 1917, and thus included men who had enlisted under varying conditions. There were men of the old Army, of Kitchener's Army, Derby recruits, men from abroad who joined up voluntarily, and men called up for National Service. Without any thought of studying the cases collectively, I had fortunately made a careful record and ophthalmoscopic examination of every case of myopia, and this facilitated the enumeration. Accordingly, I excluded all cases in which there was an active or passive pathological condition, as well as those in which mis-statements as to visual acuity had been proved.

As regards astigmatism, a rule of thumb had to be adopted. When the cylinder was equal to or lower than the sphere, half its strength was added to the sphere. A case in which the cylinder was higher than the sphere was not counted, for the reason that a high cylinder with a low sphere is not inconsistent with fair vision. Finally, the limit of $\frac{6}{18}$ was fixed, vision better than this being assumed to be good for military purposes.

It would not be difficult to pick holes in this method, and I would gladly adopt suggestions from those who have given the subject some thought. My defence is that some plan or other had to be worked out before the count could be made, and I am conscious of many side-issues, which, however, would have led to interminable

TABLE.—*Showing the Number of Eyes per Mille in each Degree of Visual Acuity, analysed according to the Amount of the Dioptric Error.*

	0·5.	1.	1·5.	2.	2·5.	3.	3·5.	4.	5.	6.	7 to 9.	10 to 12.	13 to 15.	16 and over.	I. Ratio per cent. of V.A.	II. Mean of V.A. in terms of dioptres.
$\frac{6}{18}$	5	12·5	15	5·5	3	0·5	1	—	—	—	—	—	—	—	4·25	1·43
$\frac{6}{24}$	—	5·5	18·5	14·5	10·5	5	3	0·5	—	—	—	—	—	—	5·75	2·2
$\frac{6}{36}$	—	2·5	17·5	33·5	25	16·5	5	5·5	4·5	—	—	—	—	—	11	2·45
$\frac{6}{60}$	—	—	5	23	26·5	26·5	23·5	21	14·5	8·5	9	1·5	—	—	15·90	3·63
$\frac{6}{9 0}$	—	—	—	3	6·5	8	7	8	8·5	4	4·5	0·5	—	—	5	4·215
$\frac{6}{12 0}$	—	—	—	1	6·5	14	10·5	5	11	6	7	1	—	—	6·20	4·43
$\frac{6}{18 0}$	—	—	—	4·5	11	22·5	15·5	37·5	32	21·5	29·5	9·5	2·5	1	18·70	5·31
$\frac{6}{24 0}$	—	—	—	—	3·5	10·5	8	9	25	27·5	35	15	5	2	14·05	6·7
$\frac{6}{36 0}$	—	—	—	—	—	0·5	1	8	17	21	54·5	28·5	12	4·5	14·70	8·4
$\frac{6}{60 0}$	—	—	—	—	—	—	—	—	—	2·5	11·5	9	8	13·5	4·45	12·0
III. Ratio per cent. of D.	0·5	2·05	5·6	8·5	9·25	10·4	7·45	9·45	11·25	9·1	15·1	6·5	2·75	2·1	100·00	—
IV. Mean of D. in terms of V.A.	$\frac{6}{18}$	$\frac{17·4}{60}$ ($\frac{6}{24}$)	$\frac{13·7}{60}$ ($\frac{6}{36}$)	$\frac{9·8}{60}$	$\frac{7·83}{60}$ ($\frac{6}{60}$)	$\frac{5·7}{60}$	$\frac{5·3}{60}$	$\frac{4·1}{60}$	$\frac{3·58}{60}$	$\frac{2·64}{60}$	—	—	—	—	—	—

complications. For practicable purposes the inquiry had to be reduced to its simplest terms.

As has been said, one thousand myopic eyes were taken as they came, and their ratios and means worked out. But in order to check the results and to ascertain if these were not accidental, a second thousand eyes were counted under similar conditions.

As the figures of the second thousand corresponded closely with those of the first, I grouped the two thousands together, and put them in tabular form, as shown on p. 256.

The top line gives dioptres, the left-hand vertical column the visual acuity. The figures contained by these lines represent the number of eyes per thousand occurring in each degree of visual acuity, analysed according to the amount of myopia.

Column I gives the ratio per cent. of the various degrees of visual acuity in the eyes counted, irrespective of the amount of myopia.

Column II gives the mean of visual acuity in terms of dioptres. Thus, the mean of $\frac{6}{18}$ was found to be rather less than 1·50 D., and of $\frac{6}{36}$ to be not quite 2·50 D.

The horizontal line (III) gives the ratio per cent. of the various amounts of dioptres; thus, 8·50 per cent. of the eyes counted had 2·00 D. of myopia.

The lowest line (IV) gives the mean of dioptres in terms of visual acuity. Thus, an eye with 1·00 D. saw not quite $\frac{6}{18}$, but better than $\frac{6}{24}$.

The interesting point to be determined was the approximate amount of myopia with a visual acuity of $\frac{6}{60}$, and this was found to be a fraction more than 3·50 D. Conversely the mean of 3·00 and 3·50 D. lay between $\frac{5}{60}$ and $\frac{6}{60}$.

The analysis brought to light the human factor which, in an investigation of this kind, has to be reckoned with. If the percentages in column I are compared, it will be seen that there is a striking drop in the number of eyes seeing $\frac{5}{60}$ and $\frac{4}{60}$. This drop was present in each group

of a thousand eyes, and suggests that the alleged difficulty in identifying "the top letter" at the standard distance did not exist. It should be stated that the illumination of the test-types was constant. They were hung against a black background and lit from below. The distances less than $\frac{6}{60}$ were measured off accurately.

If time permitted it might be profitable to examine these figures closely and to compare them with a similar analysis of myopic eyes in civil practice. The present purpose is to lay before you the results of the calculations, and these, with due allowance for error on the part of the men examined, may be of use in the solution of a difficult problem, namely, the visual efficiency of the myopic soldier.

Capt. CRUISE asked whether the people referred to who had 3·5 or 4 D. were accustomed to wear glasses all the time. People who had that degree of myopia and did not use glasses habitually picked up a good deal of detail and more readily than those who did, and, by screwing up the eyes, they had vision about $\frac{6}{18}$. On the other hand, people who had only 2·5 dioptres myopia and wore glasses regularly did not know how to find their way about without them.

Mr. HARRISON BUTLER said he had wondered what was the real relation between the actual visual acuity and the amount of myopia. He had himself 2 and 2·5 D., and practically no astigmatism, and he could rarely see more than $\frac{6}{36}$, and even that was rather fuzzy. But with his glasses he had nearly $\frac{6}{3}$ in one eye and $\frac{6}{3}$ partly in the other. What one saw in test-types had but little relation with one's vision of actual objects. He rarely ever used his glasses except to read a board or to look at retinoscopy shadows; he could see unaided practically all he wanted to—trees on the horizon, and so on—and he believed he could, unaided by glasses, shoot at things on the horizon. The whole question at the moment was the degree of myopia in the recruit. The Army authorities should state

the amount of myopia which would not constitute a bar to the admission of men to certain grades. There were thousands of men grade 1 except in the matter of sight who were excluded from that grade because they could not see $\frac{6}{24}$. The standard had now been lowered to $\frac{6}{60}$ —a more sensible figure. But men with high degrees of myopia were seeing $\frac{6}{60}$; they were being admitted, yet were not suitable. Recently he saw a man with -10 admitted; he did not know how he saw $\frac{6}{60}$; he came to him (the speaker) as a private patient. A man with -5 or -6 should not be classed grade 1, but a man with anything to -3 ought to be so classed.

Capt. Thomson Henderson said he could not agree with Mr. Harrison Butler on the question of grading the myopic men in the Army. There certainly was an extraordinary difference in the amount of myopia and the degree reported from the visual tests. He was once at a recruiting board at Exeter, and saw a number of very high myopes—of 10 and over 10 D.—and, to his surprise, a great number of them had vision $=\frac{6}{60}$. [Mr. Butler: That is what I said.] There was no question that this was due to these men never having worn glasses—a fact which made all the difference to the visual standard found on testing.

Mr. F. Richardson Cross said he did not consider there was any doubt that the power of seeing even among those who saw badly varied according to what the person was regularly doing in life. Educated people, such as schoolmasters, would more readily decipher words and letters, others figures; people leading a country life would see objects or movements at a distance with comparative ease. It did not seem to him right that the proper qualification for a soldier should depend on the lens he was wearing. The question rather was, what was his capacity for making fair use of his sight? We wanted our soldiers to be able to escape danger and to destroy the enemy. This would largely depend on the power of realising with the brain the meaning of a more or less

imperfect retinal picture. With the same refractive error one man would see fairly, while another would fail to do so.

Capt. Stack said it had been noticed how averse a man with myopic eyes was to wearing glasses when shooting; he much preferred to be without them. Very much, he thought, would depend on the soldier being taught what he ought to see and what he ought not to see. It would be interesting to compare, from the present point of view, a thousand recruits with a thousand ordinary civilian hospital patients.

Capt. Wallace, in reply, said he had watched for men when examined screwing up their eyelids. A large number of the men had their own glasses. Many who came up under the Derby scheme were cases of extreme myopia. Of 2000 myopic eyes he examined, 79 per cent. were unable to see $\frac{6}{60}$.

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3. *Vision and work—the results obtained at a recruiting office.*

By Freeland Fergus.

The Workmen's Compensation Act of 1906 was, perhaps, the first incident in our national life to call attention prominently to what may be styled the economics of eyesight. Immediately on the passing of that Act I became very busily engaged in cases of defective eyesight coming up for compensation. For some years I was largely employed as ophthalmic adviser to a number of insurance companies, particularly to the Scottish Mine Owners' Insurance Company, and thus did a great deal of work of this special kind, continuing to do so till I was appointed one of the ophthalmic referees for the county of Lanark. From that moment I determined to give up all insurance appointments, as I felt it to be extremely invidious to be assessing a case in a court on one day and to be giving evidence, perhaps in that same court, or in some other, on a following day. Thus, for a number of years before the war broke out, any work that I did

was entirely as a referee. I should like, however, briefly to mention that I summed up the results of these few years of work in short contributions made to the British Medical Association, one of them at its Toronto meeting, the other at its meeting in Belfast, when I was asked to be the opener of a discussion on the subject. Since the war began I have been able to make numerous observations, the supply of patients coming from two separate sources. In the first place, as ophthalmic surgeon to the 4th Scottish General Hospital I have made the ophthalmic examination of recruits and soldiers undergoing training. In most of these cases a note has been made of the civil occupation of the soldier or recruit before he entered His Majesty's Service. A careful examination has been made of every patient coming before me in the 4th Scottish Hospital. I think I can say with all truthfulness that I personally have given these patients the same overhaul that I would have given to patients in my own rooms.

But another, even more prolific, field of observation was opened to me. There can be no doubt whatever that large numbers of men were passed into the Service in the early days of the recruiting who should never have been there at all. I just mention three whom I saw in the same week in the consulting-room of the 4th Scottish General Hospital. One of them, a man over thirty, had well-marked congenital cataract, visual acuteness much less than $\frac{6}{60}$, and that man had been, as a Highland soldier, in the firing-line. This may seem an extreme case, but it is by no means the worst. On the very same day there came a man entirely blind of one eye—a condition of affairs which had been present for a considerable number of years. The other eye had 20 dioptres of myopia, and in the fundus of this remaining eye there was marked choroidal atrophy. This man also had been passed for general service. The third case was that of a soldier serving as an orderly with the R.A.M.C., who had, according to retinoscopic inspection, not less than 36 dioptres of myopia in each eye with a considerable

staphyloma towards the macula. This patient was also seen by my friend, Major Hugh Walker, who confirmed the diagnosis as regards the extremeness of the error.

As already indicated, in the autumn of 1915 the War Office took steps to have matters improved. I was asked to do the work for one of the Glasgow Boards honorarily, and I continued steadily all through the year 1916 to see these recruits. It was no easy task, for every patient had to be examined precisely as a private patient would have been examined. Every patient was examined with the ophthalmometer, with direct ophthalmoscopic examination and with trial lenses, and I made a suggestion to the Scottish Command that, in future, recruiting officers should invariably write on the medical history sheet a prescription for glasses where the sight was defective. I felt that by so doing valuable time would be saved, for I hoped that a young recruit would enter the Army with his prescription on his medical history sheet, and thus be properly classified as regards his eyesight at once. I saw more than 1600 recruits in that year, and entered the prescription on the medical history sheet of every one of these men when it was necessary to do so. Duplicates were made of 1200 of these examinations and duly filed, and it is that material which I respectfully wish to submit in this communication. It must be said, however, that a very considerable number of them are not available for use, as the notes are too imperfect.

Before entering further on the matter, there are one or two general observations which I would like to make. In the first place, I do not think any mathematical formula can be given connecting visual acuteness with visual efficiency. I am well aware that learned attempts have been made to connote these two things, and I venture to think that if the problem were at all solvable two British ophthalmic surgeons, who have both made valuable contributions, would have arrived at satisfactory results. Sir George Berry, of Edinburgh, and Mr. Percival, of Newcastle-on-Tyne, have each made

valuable contributions. But with all possible respect to the great authority which must always belong to anything said by these gentlemen, I venture to say that from that point of view the problem is insolvable. I believe it was the late Prof. Peter Guthrie Tait who once enunciated the proposition that it is quite impossible to express by mathematical formula anything which depends upon human volition, and I agree with that statement. To my mind the problem, from a strictly mathematical point of view, is insolvable. What a man with defective sight can do depends on his mentality, depends upon his resourcefulness, and is not necessarily a function of his visual acuteness. Let me quote one or two extreme cases. I have seen a perfectly blind man go into a railway station, proceed to the booking-office, take a ticket, then walk along a platform and enter a carriage of the train by which he intended to travel. I have also known a blind man who was an excellent card player, and who also on one occasion during a heavy snowstorm climbed out upon the leads of his own house to shovel off the snow.

Now, on the other hand, I have known blind people who could not leave their own houses unless accompanied by someone with eyesight. Yet so far as visual acuteness is concerned, in all these cases the visual acuteness was *nil*. I venture to think that such instances abundantly show how impossible it is to evaluate working efficiency in terms of visual acuteness. In the Toronto paper already referred to, I mentioned the case of a young lad with retinitis pigmentosa, the visual acuteness being about $\frac{1}{60}$ in each eye, who yet was actively employed at the face of a coal-pit. The visual efficiency of that man would be put down as *nil*, and yet he was earning full wages as a collier. It would, of course, be grossly wrong in any judicial proceedings to say that because such a case occurred that any blind man was fit for work at the bottom of a coalpit. Were I acting as assessor in a case of that sort I certainly would advise the presiding Judge that, in my opinion, the individual was not fit for any

form of work below ground. For these reasons, as already indicated, I beg with every possible respect to suggest that working efficiency cannot be expressed in terms of visual acuteness.

However this may be, better results may be obtained from the actuarial side. I have no intimacy whatever with actuarial science, but it seems to me that some results may be obtained by the collection of sufficiently large statistics. It is with this idea in view that I venture to place some of the statistics which I have obtained before those interested. The number of observations given in this paper is relatively not large, and I would be the last man in the world to found anything upon them; still, I venture to think that they are suggestive. There can be no doubt that many men whose vision, in the opinion of most of us, absolutely unsuits them for military service, have been able in years past to do satisfactory work in civil life. Take but one example. A carter with 15 dioptres of myopia in both eyes for many years earned good wages as a carter. He was called up for duty, and I reported that a man with 15 dioptres of myopia was not a man who should be in the Army. The President of the Medical Board objected to that view, and not unnaturally. He said if a man were able for carting in civil life surely he could do something in the Army. Well, if you select a very special employment in the Army and keep him to that, he may do well enough, but there is always this consideration—that a man who has for years worked at an employment does it almost mechanically and very nearly without eyesight. He does not use his visual acuteness at all, but that function which I call his form-sense, and to which I shall refer immediately. Take him from work with which he has been familiar for many years, and put him in entirely new conditions to do work which he has never done before in a place or places with which he is entirely unfamiliar, he cannot be expected to do it successfully. I could not help thinking that men with extreme errors of that kind might be of considerable value to the

country in civil life, but that they would be practically useless for military careers. I could not but express the opinion that a man engaged in carting with 15 dioptres of myopia, and doing it well, was likely to be of more service to the country than the same man in a labour battalion. That, however, is scarcely for me to say. The ultimate responsibility for the answer which must be given to such a question rests with the military authorities at Headquarters. Their opinion, of course, is final, and it ought to be well informed.

There is another remark that I should like to make, and that is as to the difference between visual acuteness and the form-sense. I think I first pointed out the extreme importance of this differentiation when I was examined before the Royal Commission on Seamen's Eyesight. Unfortunately, in text-books the two are regarded as synonymous, and they are not. Visual acuteness is purely a macular function; the form-sense is a function of the entire field of vision. Most manual work depends upon the form-sense and not upon the visual acuteness. Elsewhere I have already drawn attention to what I call the field of visual acuteness. It is easily illustrated in the following manner: If an individual be asked to look at a word at the centre of a page of print, he will find that he can read the letters exactly at the point of fixation, and those occupying the projection of a very small angular aperture in its immediate neighbourhood. Some years ago I had special letters printed for the examination of the field of visual acuteness and examined a number of students and others, and found that on the average the field of visual acuteness subtended an angle of a very few degrees at the first nodal point of the eye. I do not admit that the function of visual acuteness, in the strict sense of the term, extends beyond the macular region, but in other parts of the field of vision the form-sense comes directly into play.

An easy method of showing the difference between visual acuteness and the form-sense is as follows:

If the observer sits in a room and fixes distinctly a particular word in the middle of a page of printing, he will find that he sees a few letters quite distinctly in the immediate neighbourhood of that word, but none others on that page. He can, however, without taking his eyes off the word which is used for the point of fixation, tell perfectly well the shapes and forms of all the common objects in the room. To the macular fixation, which gives him power of reading, I confine the name visual acuteness. To the other function, which enables him to detect the forms and shapes of all objects in his neighbourhood, I confine the other phrase—form-sense. How long I have done so I cannot say, for I find that in my Toronto paper, already referred to, I have regarded the two as synonymous. They are not, and must be carefully distinguished. As already indicated, I made that point quite clear when I gave evidence before the Royal Commission on Sailors' Eyesight. One source of confusion must be carefully guarded against. With the retina, outside of the macular area, it is possible to recognise by the form-sense the form of a chair or a table or other article in the room. Now, it is equally possible to recognise, say, four broad lines arranged in the form of the letter E. That, however, is not visual acuteness in the strict sense of the term. You might scatter objects of that sort all over the periphery of the field of vision and be able to see them all simultaneously. Therein it differs from visual acuteness, because, for a particular page of ordinary letterpress printing, it is only the letters in the macular part of the field that are recognised, and none others.

And here, perhaps, a little digression may be allowed. Since toric lenses have been introduced, a number of spectacle vendors, in certain advertisements in various publications, show that a person provided with a toric lens has equal visual acuteness for all parts of the field of vision. That would be possible only if the whole of each retina were a mass of maculæ, which it is not. It only shows that, although a certain number of spectacle sellers

have made considerable progress in carrying out scientifically the behests of ophthalmic surgeons, yet that there are still some of them who know next to nothing of the function of vision. An advertisement of that kind does not show a scientific fact; it merely shows the ignorance of the advertiser. This is not the proper place to enter into a discussion of toric lenses, but from experiments which I have carried out, I think it can be shown that when the lenses are thin, toric lenses have no advantage whatever over the ordinary spherical or sphero-cylindrical. For thick lenses, of course, the matter is different, and one of the great services which Mr. Percival, of Newcastle-on-Tyne, has rendered to ophthalmic science is his classic paper on meniscus lenses for the after-treatment of cataract patients. Quite recently I have seen advertisements by different firms, representing an individual provided with one of their special toric lenses, seeing letters equally clearly and simultaneously straight in front and at angular apertures of about forty degrees above and forty degrees below the central line of fixation, which condition could only be realised if the individual fitted were the unfortunate possessor of three maculæ.

Now, as already indicated, for most manual work it is the form-sense that is used and not the visual acuteness, and that is an element which, to my way of thinking, renders it impossible to form a mathematical formula connecting vision with working efficiency. For example, navigation very largely is a matter of the form-sense. It is quite true that visual acuteness sometimes must be used. A man may have to read the soundings on a chart, or he may have to read an indicator or take out figures from logarithmic tables. All these are processes which require visual acuteness, but the work of the look-out is almost entirely done by the form-sense. An officer of the watch, while looking straight in front of him, may become aware, not by that small part of the field of vision which is associated with visual acuteness, but by some other part in which there is form-sense, that there is on the horizon,

say, an island, or a lighthouse, or another ship. No doubt he will likely turn that part of the field of vision which is possessed of visual acuteness on this new object, but he need not necessarily do so, and, in fact, if he is intent on the first object, he may content himself with bestowing what is called the tail of his eye to the second. There is scarcely any form of purely manual labour where visual acuteness is required. It is all but entirely done by the form-sense. A man does not necessarily use his visual acuteness when wheeling a barrow or when using a pick or a hammer, or when employing almost any implement of agriculture. In the Toronto paper already referred to, I mentioned the case of a collier, with 15 dioptres of myopia and visual acuteness of only $\frac{1}{30}$, who had worked for many years, earning full wages, and who had not the remotest idea that there was anything wrong with his sight till he tried to get employment in the service of a railway company. For other cases of a perfectly similar nature I may refer to the same paper, which was published in the *British Medical Journal*, vol. ii, 1906, pp. 1865–1866. Finally, in walking along a street, a man, for the most part, reads the signs and the names of the streets by his visual acuteness, but he almost invariably avoids his fellow-men who are walking on the same thoroughfare by his form-sense and not by his visual acuteness. Those parts of the field of vision which have the form-sense have also the sense of projection.

One other preliminary remark I wish to make. When I began to test recruits I desired to establish a relationship between the amount of myopia present in a particular eye and the visual acuteness. I admit at once, of course, that a man cannot be an efficient soldier without good visual acuteness, and it seemed to me an important matter, in view of cases of possible malingering, to determine what degree of myopia, in an eye otherwise perfectly healthy, would give a visual acuteness of $\frac{6}{60}$ or less. The method I took to solve this question was an easy one. I selected from the wards of the hospital a considerable number of

patients who were not in on account of any defective eyesight, and I took those of them who had in each eye $\frac{6}{6}$ of visual acuteness or better, and whose refraction, as determined by the ophthalmometer and direct examination with the ophthalmoscope, was approximately emmetropic. I placed in front of such eyes convex lenses, and in something like thirty observations I found that a plus 3 in front of such an eye reduced the visual acuteness to $\frac{6}{60}$. There is no doubt, of course, that that does not give the eye exactly 3 dioptres of myopia, but it does it so approximately as to make the figure of some value. I have since discovered that in myopic persons that result is fairly accurate. You will all but invariably find that, given a person with not more than 3 dioptres of myopia and a perfectly healthy fundus free from all choroidal disease, the patient has apparently a visual acuteness of $\frac{6}{60}$. I think probably that it is not, in the strict sense of the term, visual acuteness, but that such a person has the form-sense sufficiently to read the largest of Snellen's scale. Lesser amounts of myopia give, of course, better vision. If a man had 3 dioptres of myopia or under it, and did not have apparent visual acuteness of $\frac{6}{60}$, that would raise in my mind a suspicion that the answers were not being fairly and exactly given. And here I think it right to say that the number of men who deliberately malingered was extremely small. I did not take accurate figures of the amount, but I would be surprised if it amounted, for the examinations which I made, to more than a fraction of 1 per cent. There was all but invariably something tangible to account for the difficulty of vision. It must also be remembered that the 1600 recruits whom I saw were only the men concerning whose vision the Medical Board had difficulty. They were a mere fraction of the number that appeared before the recruiting authorities in the Glasgow area.

Occupation.	Ophthalmometer readings.		Vision without glasses.		Correction and vision obtained.		Remarks.
	R.	L.	R.	L.	R.	L.	
Marine stoker	$2\frac{1}{2}$ W.	$3\frac{1}{2}$ W.	$\frac{6}{60}$	$\frac{6}{36}$	S.−10, C.−2·3, A. 15°, $\frac{6}{36}$	Cyl.−4, A. 170, $\frac{6}{12}$	Stoked C.P.R. boats for last eight years.
House painter	$1\frac{1}{2}$ W.	1 W.	$\frac{6}{12}$	$\frac{6}{6}$	W.+1, A. 100, $\frac{6}{9}$	Does not take glass	—
Coachman	—	3 W.	$\frac{6}{18}$	$\frac{6}{24}$	—	—	Incipient cataract in left.
Drawer in colliery	$2\frac{1}{2}$ W.	1 W.	$\frac{6}{60}$	$\frac{6}{9}$	S.−2·75, C.−2, A.170, $\frac{6}{18}$	C.−0·75, A. 90, $\frac{6}{6}$	—
Spirit salesman	$1\frac{1}{2}$ A.	$1\frac{1}{2}$ W.	$\frac{6}{24}$	$\frac{6}{36}$	S.−1, C−1·5, A. 100, $\frac{6}{18}$	S.−1, C.−15, A. 90, $\frac{6}{18}$	Correction made under homatropine.
Storeman in shipyard	S.A.	S.W.	$\frac{6}{60}$	$\frac{6}{60}$	S.+4·5, $\frac{6}{9}$	S.+4, vision $\frac{6}{12}$	No cylindrical correction taken.
Not noted	$1\frac{1}{2}$ W.	$1\frac{1}{2}$ W.	$\frac{6}{36}$	$\frac{6}{60}$	S.−2, C.−1·5, A. 180, $\frac{6}{18}$	S.−2, C.−15, A. 180, $\frac{6}{18}$	—
Boiler fireman	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.−10, $\frac{6}{12}$	S.−10, $\frac{6}{12}$	—
Fireclay manufacturer	1 W.	$2\frac{1}{2}$ O.	$<\frac{6}{60}$	$\frac{6}{24}$	S.−7, $\frac{6}{9}$	C.−2·5, A. 160, $\frac{6}{9}$	—
Marine stoker	$1\frac{1}{2}$ W.	$2\frac{1}{2}$ A.	$\frac{6}{5}$	$\frac{6}{60}$	No correction	C.+2, A. 170, $\frac{6}{12}$	—
Cook	1 W.	1 W.	$\frac{6}{60}$	$\frac{6}{36}$	S.−0·5, C.−1·5, A.10, $\frac{6}{12}$	C.−1·5, A. 10, V. $\frac{6}{12}$	—
Salesman	S.W.	S.W.	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−16, $\frac{6}{36}$	S.−16, $\frac{6}{36}$	—
Sheet iron worker	*nil*	S.A.	$<\frac{6}{60}$	$\frac{6}{6}$	S.+5·0, $\frac{6}{24}$	S.+1, $\frac{6}{6}$	No cylinder taken in right.
Tailor	*nil*	*nil*	$\frac{6}{24}$	$\frac{6}{24}$	S.−1, $\frac{6}{6}$	S.−1, $\frac{6}{6}$	—
Belt maker	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−12, V. not noted	Above −12	This man works with glasses.
Apprentice caulker	—	—	$\frac{6}{9}$	*nil*	—	—	Fundus changes in left eye. One-eyed man, caulker.
Clerk	S.A.	S.A.	$\frac{6}{60}$	$\frac{6}{60}$	S.−2, C.−0·5, A. 90, $\frac{6}{6}$	S.−2, 6−0·5, A. 90, $\frac{6}{6}$	—
Sawmill labourer	—	—	$\frac{6}{60}$	$\frac{6}{24}$	—	—	Tobacco amblyopia. No difficulty for work.
Clerk	$3\frac{1}{2}$ W.	3 W.	$\frac{6}{24}$	$\frac{6}{36}$	C.+3·5, A. 100, $\frac{6}{18}$	C.−A. 80, $\frac{6}{12}$	—
Metal dealer	—	—	—	—	—	—	Left eye blind; right 12 D. of myopia.
Gas-worker	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.+7, $\frac{6}{18}$	S.+4, $\frac{6}{18}$	—
Engineer	—	—	$\frac{6}{6}$	$<\frac{6}{60}$	—	—	Left eye nearly blind from squint.
,,	S.W.	S.W.	$\frac{6}{36}$	$\frac{6}{36}$	S.−2·5, $\frac{6}{18}$	S.−2·5, $\frac{6}{18}$	Phlyctenular conjunctivitis; was rejected at first.
Shipbroker	*nil*	*nil*	$<\frac{6}{60}$	$\frac{6}{6}$	No improvement	—	Right eye practically blind from squint.

Shop assistant	$2\frac{1}{2}$ A.	2 A.	$\frac{6}{36}$	$\frac{6}{36}$	C. + 2·5, A. 160, $\frac{6}{12}$	S. + 1, C. + 2·5, A. 35, $\frac{6}{12}$	—
Fireman	I.	I.	$\frac{6}{36}$	—	S.−2, V. $\frac{6}{18}$	—	Left practically blind from nebula.
Hospital steward	$1\frac{1}{2}$ W.	$1\frac{1}{2}$ W.	$<\frac{6}{60}$	$<\frac{6}{60}$	S. + 5·0, $\frac{6}{6}$	S. + 5·0, $\frac{6}{6}$	Does not take cylinders.
Blacksmith	2 W.	$2\frac{1}{2}$ W.	$\frac{6}{36}$	$\frac{6}{36}$	C. + 2, A. 90, $\frac{6}{24}$	C. + 2·5, A. 100, $\frac{6}{12}$	—
Labourer	$1\frac{1}{2}$ W.	$1\frac{1}{2}$ A.	$\frac{6}{36}$	$\frac{6}{36}$	S.−5·0, C.−1·5, A. 20, $\frac{6}{12}$	S.−5·0, C. 1, A. 90, $\frac{6}{12}$	—
Munition worker	*nil*	1 A.	$\frac{6}{12}$	$\frac{6}{24}$	C. + 0·5, A. 180, $\frac{6}{9}$	C. + 1·5, A. 180, $\frac{6}{9}$	—
Spirit salesman	$3\frac{1}{2}$ W.	4 W.	$\frac{6}{36}$	$<\frac{6}{60}$	C. + 3, A. 100, $\frac{6}{12}$	C. + 4, A. 90, $\frac{6}{60}$	Very defective in one eye.
Upholsterer	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.−16, $\frac{6}{18}$, letters	S.−16, V. $\frac{6}{18}$, letters	—
Riveter	2 W.	2 W.	$\frac{6}{18}$	$\frac{6}{18}$	S. + 1, C. + 2, A. 90, $\frac{6}{9}$	S. + 1, C. + 2, A. 90, V. $\frac{6}{9}$	—
Tobacco cutter	—	—	—	—	—	—	Right eye blind from separation of retina, left myopia; 14 D.
Mercantile clerk	$3\frac{1}{2}$ W.	$3\frac{1}{2}$ W.	$\frac{6}{60}$	$\frac{6}{60}$	S. + 2·5, C. + 3·5, A. 105, $\frac{6}{6}$	S. + 3, C. + 3·5, A. 75, V. $\frac{6}{6}$	—
Printer	$2\frac{1}{2}$ W.	*nil*	$\frac{6}{60}$	$\frac{6}{9}$	S.−2, C.−2·5, A. 10, V. $\frac{6}{12}$	*nil*	—
Grocer	*nil*	*nil*	$\frac{6}{36}$	$\frac{6}{9}$	Not improved	—	Amblyopia of right due to squint.
Sawmill labourer	S.A.	S.A.	$\frac{6}{24}$	$<\frac{6}{60}$	S. + 4, $\frac{6}{18}$	No improvement	Amblyopia of left due to squint.
Violinist	S.A.	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−7, C.−0·75, A. 100 $\frac{6}{6}$	S.−8, C.−0·5, A. 90, $\frac{6}{12}$	—
Labourer	S.W.	S.W.	$\frac{6}{9}$	$<\frac{6}{60}$	—	No improvement	Squint in left eye.
Platelayer	—	—	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−18, $<\frac{6}{60}$	S.−20, $<\frac{6}{60}$	Marked choroidal changes.
Driver in coalpit	1 A.	$\frac{1}{2}$ A.	$\frac{6}{60}$	$\frac{6}{60}$	S.−5·5, C.−2, A. 100, V. $\frac{6}{9}$	S−4·5, C.−1, A. 80, V. $\frac{6}{9}$	—
Tramcar conductor	1 W.	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.−4, C.−1, A. 15, $\frac{6}{18}$	S−2, $\frac{6}{9}$	—
Tinsmith	$1\frac{1}{2}$ W.	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−8, $\frac{6}{9}$	S.−10, $\frac{6}{24}$	—
Spirit salesman	—	—	$<\frac{6}{60}$	$\frac{6}{6}$	—	—	High myopia in right; vision not improved by glass.
Stevedore's labourer	$1\frac{1}{2}$ W.	*nil*	$\frac{6}{24}$	$<\frac{6}{60}$	S. + 4·5, Cyl. + 1, A. 90, $\frac{6}{6}$	S. + 6, $\frac{6}{6}$	Squint in left eye.
Insurance agent	5·0 A.	5·0 A.	$<\frac{6}{60}$	$<\frac{6}{60}$	—	—	Errors extreme; about S.−10. C.−5·0.
Music hall artist	$2\frac{1}{2}$ W.	0·5 W.	$<\frac{6}{60}$	$\frac{6}{9}$	Not improved	—	—
Commercial traveller	*nil*	*nil*	$\frac{6}{36}$	$\frac{6}{24}$	S.−3, $\frac{6}{9}$	S.−2·5, $\frac{6}{6}$	—
Clerk	—	—	—	$\frac{6}{6}$	—	—	Right eye blind from degeneration cataract.
Salesman	$2\frac{1}{2}$ O.	$2\frac{1}{2}$ O.	$\frac{6}{36}$	$\frac{6}{36}$	C. + 2·5, A. 40, $\frac{6}{18}$	S. + 1, C. + 2·5, A. 165, $\frac{6}{18}$	—
Book salesman	$1\frac{1}{2}$ W.	$1\frac{1}{2}$ W.	$\frac{6}{60}$	$\frac{6}{60}$	S.−2·5, $\frac{6}{6}$	S.−2, C.−0·5, A. 90, $\frac{6}{6}$	—

Occupation.	Ophthalmometer readings.		Vision without glasses.		Correction and vision obtained.		Remarks.
	R.	L.	R.	L.	R.	L.	
Bonded storeman	*nil*	*nil*	$\frac{6}{12}$	$\frac{6}{60}$	S. + 2, V. $\frac{6}{6}$	S. + 4, V. $\frac{6}{18}$	—
Dock labourer	S.W.	S.W.	< $\frac{6}{60}$	$\frac{6}{24}$	S. − 5·0, $\frac{6}{36}$	S. − 2, $\frac{6}{18}$	—
Telegraph linesman	—	—	$\frac{6}{12}$	*nil*	—	—	Lost sight of left eye 16 years ago.
Salesman	S.W.	S.W.	$\frac{6}{24}$	$\frac{6}{12}$	Not improved	Cyl. 0·75, A. 180, $\frac{6}{6}$	—
Shipping clerk	—	—	*nil*	$\frac{6}{18}$	,, ,,	Cyl. + 2·5, $\frac{6}{6}$	—
Ship caulker	*nil*	*nil*	< $\frac{6}{60}$	< $\frac{6}{60}$	,, ,,	S. − 7, $\frac{6}{18}$	—
Engine fitter	$\frac{1}{2}$ W.	$\frac{1}{2}$ W.	< $\frac{6}{60}$	< $\frac{6}{60}$	S. − 6, C. − 0·75, A. 180, $\frac{6}{18}$	S. − 6, C. − 0·75, A. 180, $\frac{6}{18}$	—
Cabinet maker	3 W.	3 W.	$\frac{6}{60}$	*nil*	C. + 3·25, A. 95, $\frac{6}{18}$	No improvement	—
Shipyard labourer	—	—	$\frac{6}{36}$	$\frac{6}{36}$	Not improved	Not improved	There is a nebula on cornea of each eye.
Collier	—	—	< $\frac{6}{60}$	< $\frac{6}{60}$	—	—	In each eye about 18 D of myopia with staphyloma. Has worked as a collier below ground for 10 years.
Sawmill labourer	*nil*	1½ W.	$\frac{6}{6}$	$\frac{6}{60}$	—	Not improved	In left H. = 6 D. Eye practically blind.
Picture-frame maker	3 W.	2 W.	$\frac{6}{24}$	$\frac{6}{60}$	C. − 3, A. 20, $\frac{6}{18}$	S. − 2·75, C. − 2, A. 175, V. $\frac{6}{18}$	—
Private	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{9}$	E. nearly	E. nearly	Squint in right eye.
Tea salesman	1 O.	*nil*	$\frac{6}{60}$	$\frac{6}{6}$	S. − 4, $\frac{6}{6}$	—	—
Working tailor	1 W.	*nil*	< $\frac{6}{60}$	$\frac{6}{60}$	S. − 5·0, $\frac{6}{24}$	S. − 3, $\frac{6}{18}$	Opacity in each lens.
Electrician	*nil*	*nil*	< $\frac{6}{60}$	$\frac{6}{18}$	No improvement	S. + 5·0, $\frac{6}{9}$	—
Motor driver	*nil*	*nil*	$\frac{6}{6}$	$\frac{6}{60}$	—	S. + 5·0 gives $\frac{6}{18}$	—
Navvy	1 W.	1½ W.	$\frac{6}{60}$	$\frac{6}{60}$	S. − 5·0, C. − 1, A. 160, $\frac{6}{9}$	S. − 3. C. − 1·5, A. 15, V. $\frac{6}{18}$	—
Labourer	S.A.	1½ A.	$\frac{6}{60}$	$\frac{6}{60}$	Not improved	Not improved	Diagnosed as a case of tobacco amblyopia.
Jobbing cutler	1½ W.	1½ W.	$\frac{6}{18}$	$\frac{6}{18}$	S. − 0·5, C. − 1·75, A. 15, V. $\frac{6}{9}$	C. − 1·5, A. 10, V. $\frac{6}{9}$	—
Stonemason	1 A.	2½ O.	$\frac{6}{12}$	$\frac{6}{60}$	C. − 1, A. 105, V. $\frac{6}{6}$	S. − 1, C. − 2, A. 160, $\frac{6}{18}$	—
Labourer	4 W.	4; W.	$\frac{6}{36}$	$\frac{6}{18}$	S. + 2, C. − 4, A. 15, $\frac{6}{12}$	S. + 0·5, C. − 4·5, A. 20, V. $\frac{6}{9}$	—
Carter	2 A.	1 A.	$\frac{6}{36}$	$\frac{6}{36}$	No improvement	No improvement	Nebula on each cornea.

Cinema operator .	*nil*	*nil*	$<\frac{6}{60}$	$\frac{6}{60}$	No improvement	No improvement.	No fundus changes. About 3 D. of H. in right and about 1 in left. Probably malingerer.
Sawyer . .	$2\frac{1}{2}$	$1\frac{1}{2}$	$\frac{6}{36}$	$\frac{6}{24}$	S.−1, C.−3, A. 10, $\frac{6}{12}$	C.−1·5, A. 175	—
Cinema traveller .	$1\frac{1}{2}$ W.	*nil*	$\frac{6}{36}$	$\frac{6}{60}$	S.+5·5, C.+2, A. 20, $\frac{6}{6}$	S.+7, $\frac{6}{12}$	—
Mason . . .	$1\frac{1}{2}$ W.	*nil*	$\frac{6}{60}$	$\frac{6}{9}$	C.+2, A. 90, V. $\frac{6}{24}$	No improvement	—
Dispatch clerk .	$1\frac{1}{2}$ W.	$2\frac{1}{2}$ W.	$\frac{6}{60}$	$<\frac{6}{60}$	S.−5·0, V. $\frac{6}{18}$	S.−14, C.−2·5, A. 15, $\frac{6}{60}$	Staphyloma in L. Cyl. not taken in the R.
Shipyard labourer	$1\frac{1}{2}$ A.	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S−7, C.−1·5, A. 90, $\frac{6}{18}$	S.−16, $\frac{6}{18}$	—
Warehouseman .	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{6}$	S−6, $\frac{6}{24}$	—	—
Miner . . .	2 A.	*nil*	$\frac{6}{36}$	$\frac{6}{6}$	Not improved	—	Squint in early life.
Labourer . .	1·5 W.	1·5 W.	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−3, C.−1·25, A. 10, $\frac{6}{24}$	S.−3, Cyl.−1·5, A. 170, $\frac{6}{12}$	—
Baker . . .	—	3·5 W.	$<\frac{6}{60}$	$\frac{6}{18}$	Not improved	5+2, C.+3·5, A. 90, $\frac{6}{12}$	Atrophy in right optic nerve.
Tailor . . .	*nil*	*nil*	$\frac{6}{36}$	$\frac{6}{60}$	S.−3, $\frac{6}{6}$	S.−4, $\frac{6}{6}$	—
Iron worker .	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{18}$	No glass improves	S.+4, $\frac{6}{9}$	Probably squint amblyopia.
Warehouseman .	1 with	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.−8, C.−1·5, A. 180, $\frac{6}{24}$	S.−7, $\frac{6}{18}$	—
Coal salesman .	—	—	—	—	—	—	High myopia in right. Cataract in left. Left eye nearly blind.
Pit-head labourer	S.A.	S.A.	$\frac{6}{60}$	$\frac{6}{36}$	S.−2, C.−0·75, A. 90, $\frac{6}{6}$	S.−2, O.−0·75, A. 90, $\frac{6}{6}$	—
Quarryman . .	S.W.	S.W.	$\frac{6}{60}$	$\frac{6}{9}$	S.−3, $\frac{6}{18}$	—	—
Locksmith . .	*nil*	*nil*	$\frac{6}{9}$	$\frac{6}{60}$	—	No glass improves	—
Pit drainer . .	0·5 A.	3·5 A.	$\frac{6}{36}$	$\frac{6}{60}$	S.+3, C.+1, A. 180, $\frac{6}{18}$	S.+3, C+4, A. 10, $\frac{6}{36}$	—
Plasterer . .	2·5 W.	*nil*	$\frac{6}{36}$	$\frac{6}{24}$	C.+2·5, A. 95, $\frac{6}{9}$	C.+0·75, A. 180, $\frac{6}{9}$	—
Labourer . .	S.A.	S.A.	$\frac{6}{24}$	$\frac{6}{36}$	S.−1·5, C.−1, A. 90, $\frac{6}{12}$	S.−2, Cyl.−1, A. 90, $\frac{6}{12}$	—
„ . .	2 W.	2 W.	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−4, C.−2, A. 5, $\frac{6}{18}$	S.−5·0, C.−2, A. 5, $\frac{6}{18}$	—
Storekeeper .	*nil*	*nil*	$\frac{6}{36}$	$\frac{6}{18}$	S.+2·5, $\frac{6}{9}$	S.+1, $\frac{6}{9}$	—
Woodwork labourer	—	—	$<\frac{6}{60}$	$<\frac{6}{60}$	—	—	More than 10 D. of myopia in each.
Barman . .	1·5 W.	1 W.	$\frac{6}{60}$	$\frac{6}{12}$	Not improved	S.+1, $\frac{6}{9}$	Fundus changes in right due to injury.
Spirit salesman .	2 W.	2 W.	$\frac{6}{12}$	$\frac{6}{12}$	S.+1·5, C.+2, A. 90, $\frac{6}{9}$	S.+3, C.+2, A. 90, $\frac{6}{9}$	—
Clerk . . .	0·5 W.	1 W.	$\frac{6}{24}$	$\frac{6}{24}$	S.−1·5, C.−0·5, A. 180, $\frac{6}{6}$	S.−1·5, C.−0·75, A. 180, $\frac{6}{6}$	—
„ . . .	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S−2, $\frac{6}{6}$	S.−2, $\frac{6}{6}$	—
Horseman . .	4 W.	3 W.	$\frac{6}{24}$	$\frac{6}{24}$	S.+2, C.−4, A. 175, $\frac{6}{9}$	S.+2, C.−2·5, A. 5, $\frac{6}{18}$	—
Hammerman .	2·5 W.	1 W.	$<\frac{6}{60}$	$\frac{6}{12}$	Not improved	C.+1, A. 90, V. $\frac{6}{9}$	One-eyed man working as hammerman.

Occupation.	Ophthalmometer readings.		Vision without glasses.		Correction and vision obtained.		Remarks.
	R.	L.	R.	L.	R.	L.	
Labourer, shipyard	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.−2·5, $\frac{6}{6}$	S.−2·5, $\frac{6}{6}$	Served for six years with Royal Irish Rifles.
Pithead runner	1½ A.	1½ A.	$<\frac{6}{60}$	$<\frac{6}{60}$	No improvement	No improvement	About 16 D. myopia in each.
Labourer	2½ W.	2 W.	$\frac{6}{36}$	$\frac{6}{24}$	S.+1, C.+3, A. 100, $\frac{6}{12}$	S.+1, C.−2, A. 75, $\frac{6}{9}$	—
Pictureframe maker	2 W.	1 W.	$\frac{6}{24}$	$\frac{6}{36}$	S.+4, C.+1, A. 95, $\frac{6}{9}$	S.+5·0, $\frac{6}{9}$	—
Recruit	1½ W.	1½ W.	$\frac{6}{18}$	$\frac{6}{24}$	S.−0·5, C.−1·5, A.180, $\frac{6}{9}$	S.−1, C.−1·5, A. 180, $\frac{6}{9}$	—
Carter	—	—	$<\frac{6}{60}$	$<\frac{6}{60}$	—	—	Has about 18 D. of myopia in each, with choroidal destruction. Has no difficulty at his work.
Mercantile clerk	2 W.	2 W.	$\frac{6}{24}$	$\frac{6}{18}$	C.−2·5, A. 10, $\frac{6}{9}$	C.−2, A. 180, $\frac{6}{9}$	—
Ship stoker	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−14, $\frac{6}{24}$	S.−14, $\frac{6}{24}$	—
Janitor in office	S.W.	*nil*	$<\frac{6}{60}$	$\frac{6}{36}$	Not improved	S.+4, C.+1, A. 165, $\frac{6}{9}$	—
Chauffeur	2½ A.	2½ A.	$\frac{6}{60}$	$\frac{6}{36}$	S.−1·5, C.+3·5, A.10, $\frac{6}{18}$	S.−2, C.+3·5, A. 10, $\frac{6}{12}$	Drives without glasses.
Ploughman	*nil*	*nil*	$\frac{6}{6}$	$<\frac{6}{60}$	—	No improvement	Squint in left eye.
Joiner	1 O.	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.+5·0, $\frac{6}{12}$	S.+4, $\frac{6}{24}$	Traces of old iritis in both; worse in left.
Butcher	*nil*	*nil*	$<\frac{6}{60}$	$\frac{6}{9}$	S.−12, $\frac{6}{24}$	—	—
Flower vendor	—	—	$\frac{6}{24}$	$<\frac{6}{60}$	S.−4 improves	No improvement	Left eye very high myopia with fundus changes.
Slater	3·5 W.	1 W.	$\frac{6}{60}$	$\frac{6}{24}$	Not improved	S.−1, C.+1·5, A. 100, $\frac{6}{18}$	—
Labourer	—	—	$<\frac{6}{60}$	$<\frac{6}{60}$	„ „	Not improved	Retinitis pigmentosa in each eye, with high myopia.
„	1·5 A.	S.A.	$\frac{6}{36}$	$\frac{6}{24}$	S.+1, C.+1·75, A.170, $\frac{6}{18}$	S.+1, O.+0·75, A.170, $\frac{6}{12}$	—
Coal salesman	—	—	$\frac{6}{60}$	$\frac{6}{60}$	Not improved	Not improved	Diagnosed as tobacco amblyopia.
Goods checker	S.W.	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	Sph.−4, V. $\frac{6}{6}$	„ „	—
Bootmaker	3 W.	2 W.	$\frac{6}{36}$	$\frac{6}{18}$	Not improved	S.+1, C.+1·5, A. 90, $\frac{6}{12}$	—
Wheelwright	2·5 A.	S.A.	$\frac{6}{36}$	$\frac{6}{6}$	C.+2·5, A. 180, $\frac{6}{6}$	C.+1, A. 180, $\frac{6}{5}$	—
Labourer	—	—	$\frac{6}{9}$	$<\frac{6}{60}$	—	—	Practically blind in left eye from squint.
Labourer in boatyard	1 A.	2 A.	$\frac{6}{60}$	$\frac{6}{36}$	S.−4, C.−1, A. 90, $\frac{6}{18}$	S.−2, C.−1·5, A. 90, $\frac{6}{6}$	—

Munition worker .	3 W.	1·5 W.	$\frac{6}{6 0}$	$\frac{6}{3 0}$	S.−2, C.−3, A.180, V. $\frac{6}{1 8}$	S.−1·5, C.−2, A.160, $\frac{6}{1 2}$	—
Carter . . .	—	—	$\frac{6}{0}$	*nil*	—	—	Left quite blind from injury 12 years ago.
Labourer . .	—	1·5 W.	*nil*	$\frac{6}{3 6}$	Blind	S.−4, C.−1·5, A. 80, $\frac{6}{1 8}$	Right blind from choroiditis.
,, . .	—	—	$\frac{6}{1 2}$	$<\frac{6}{6 0}$	—	Practically blind	Nerve atrophy in left eye, probably congenital.
General dealer .	*nil*	*nil*	$\frac{6}{3 6}$	$\frac{6}{3 6}$	S.−1·5, $\frac{6}{9}$	S.−2, $\frac{6}{6}$	—
Packer . . .	S.W.	1·5 W.	$\frac{6}{6}$	$\frac{6}{1 8}$	—	S.−2, C.+1·5, A. 90. $\frac{6}{9}$	Marked squint of left. Only one eye used for fixation.
Dentist . .	*nil*	*nil*	$\frac{6}{3 6}$	$\frac{6}{9}$	Not improved	—	Squint in right eye.
Metal polisher .	*nil*	*nil*	$<\frac{6}{6 0}$	$\frac{6}{6 0}$	S.−10, $\frac{6}{2 4}$	S.−5·0, $\frac{6}{9}$	—
Labourer . .	—	—	$\frac{6}{9}$	$\frac{6}{6 0}$	—	Not improved	High hypermetropia in both; squint in left.
Scavenger . .	*nil*	2 W.	—	—	—	C.+2, A. 90, $\frac{6}{3 6}$	—
Boot finisher .	2·5 W.	2·5 W.	$\frac{6}{2 4}$	$\frac{6}{2 4}$	C.−2·5, A. 15, $\frac{6}{1 2}$	C.−3, A. 170, $\frac{6}{1 2}$	—
Ship's steward .	*nil*	3·5 W.	$\frac{6}{6 0}$	$\frac{6}{6 0}$	S.−7, $\frac{6}{2 4}$	S.−8, C.−3, A. 170, $\frac{6}{2 4}$	Opacity on left cornea.
Newsagent . .	*nil*	1 A.	$\frac{6}{1 8}$	$\frac{6}{6 0}$	S.+4, $\frac{6}{9}$	S.+4, C.−1, A. 90, $\frac{6}{2 4}$	—
Car conductor .	*nil*	*nil*	$\frac{6}{3 6}$	$\frac{6}{3 6}$	S.−6, $\frac{6}{2 4}$	S.−5·0, $\frac{6}{2 4}$	—
Tailor . . .	*nil*	*nil*	$\frac{6}{6 0}$	$\frac{6}{1 2}$	—	—	Has strabismus in right. No difficulty in seeing.
Paper box maker .	2 W.	S.W.	$<\frac{6}{6 0}$	$<\frac{6}{6 0}$	S.−2, C.−2, A. 175, $\frac{6}{9}$	S.−3, C.−0·5, A. 180, $\frac{6}{9}$	—
Music teacher .	0·5 A.	0·5 A.	$<\frac{6}{6 0}$	$<\frac{6}{6 0}$	S.−2, C.−0·75, A. 90, $\frac{6}{9}$	S.−2, C.−0·75, A. 90, $\frac{6}{9}$	—
Packer . . .	*nil*	*nil*	$\frac{6}{6 0}$	$\frac{6}{6 0}$	S.−5·5, $\frac{6}{2 4}$	S.−8, $\frac{6}{3 6}$	—
Ploughman . .	—	—	$\frac{6}{6 0}$	$\frac{6}{6}$	—	—	Defect in right, due to squint in early life.
Sorting clerk, P.O.	2·5 W.	2·0	$\frac{6}{2 4}$	$\frac{6}{2 4}$	S.−1, C.−2·5, A. 120, $\frac{6}{1 2}$	S.−1, C.−2, A. 55, $\frac{6}{2 1}$	—
Labourer . .	S.W.	S.W.	$\frac{6}{2 4}$	$\frac{6}{2 4}$	S.−4, $\frac{6}{9}$	S.+4, $\frac{6}{9}$	
Shorthand writer .	1 W.	1 W.	$\frac{6}{1 8}$	$<\frac{6}{6 0}$	—	—	Left eye high hypermetropia and practically blind.
P.O. clerk . .	3 W.	1·5 W.	$\frac{6}{3 6}$	$\frac{6}{1 8}$	C.+3, A. 85, $\frac{6}{9}$	C.+1·75, A. 105, $\frac{6}{9}$	—
Shoemaker . .	—	—	$\frac{6}{9}$	$<\frac{6}{6 0}$	—	—	Opacity of L. cornea. Has worked for many years with only one eye.
Machinist . .	1·5 W.	*nil*	$<\frac{6}{6 0}$	$<\frac{6}{6 0}$	S.−5·0, $\frac{6}{2 4}$	S.−5·0, $\frac{6}{2 4}$	—
Scavenger . .	1·5 O.	1·5 W.	$<\frac{6}{6 0}$	$<\frac{6}{6 0}$	—	S.+4, C.−1·25, A. 100, $\frac{6}{2 4}$	Tests for simulated blindness show R. practically blind.
Electrician . .	1·5 W.	1·5 W.	$\frac{6}{2 4}$	$\frac{6}{2 4}$	S.−1, C.+1·5, A. 110, $\frac{6}{1 8}$	S.+1, C.+1·5, A. 75, $\frac{6}{1 8}$	—

Occupation.	Ophthalmometer readings.		Vision without glasses.		Correction and vision obtained.		Remarks.
	R.	L.	R.	L.	R.	L.	
Rigger's assistant	S.W.	S.W.	$\frac{6}{60}$	$< \frac{6}{60}$	S. −3, $\frac{6}{9}$	S. −3, $\frac{6}{9}$	—
Shipyard labourer	1 A.	*nil*	$\frac{6}{60}$	$< \frac{6}{60}$	S. −2, C. −1, A. 90, $\frac{6}{9}$	Practically blind	—
Carter	1 A.	2·5 A.	$\frac{6}{12}$	$\frac{6}{30}$	S. −0·5, C. −1, A. 100, $\frac{6}{9}$	S. −0·5, C. −1·5, A. 80, $\frac{6}{9}$	—
Ship's steward	3 W.	3 W.	$\frac{6}{36}$	$\frac{6}{36}$	S. +2, C. +3, A. 105, $\frac{6}{18}$	S. +2·25, C. +3, A. 95, $\frac{6}{18}$	—
Labourer	1·5 W.	*nil*	$\frac{6}{36}$	$\frac{6}{12}$	No improvement	—	—
Clerk	1·5 W.	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −2, C. −2, A. 10, $\frac{6}{6}$	S. −4, $\frac{6}{9}$	—
Chemist	1·5 W.	S.W.	$\frac{6}{36}$	$\frac{6}{60}$	S. −2, C. −1, A. 170, $\frac{6}{18}$	S. −2, $\frac{6}{18}$	—
Student	*nil*	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −4, $\frac{6}{6}$	S. −4, $\frac{6}{6}$	—
Telephone linesman	$2\frac{3}{4}$	*nil*	$\frac{6}{60}$	$\frac{6}{9}$	S. +2, C. −2·5, A. 15, $\frac{6}{18}$	—	One-eyed man working as linesman.
Watchmaker	1·5 A.	2·5 W.	$\frac{6}{36}$	$\frac{6}{36}$	S. −1·5, C. −3, A. 100, $\frac{6}{18}$	S. −0·75, C. −3, A. 30, $\frac{6}{12}$	—
Surveyor	*nil*	*nil*	$\frac{6}{36}$	$< \frac{6}{60}$	S. −4, $\frac{6}{6}$	S. −4·5, $\frac{6}{6}$	—
Labourer	1·5 A.	*nil*	$\frac{6}{60}$	$< \frac{6}{60}$	S. +5·0, C. +1·5, A. 170, $\frac{6}{18}$	S. +6, $\frac{6}{24}$	—
Spirit salesman	*nil*	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −10, $\frac{6}{18}$	S. −8, $\frac{6}{18}$	—
Painter	2·50	1·5 O.	$\frac{6}{36}$	$\frac{6}{24}$	S. −2, C. −2·5, A. 130, $\frac{6}{36}$	C. +1·5, A. 35, $\frac{6}{9}$	—
Printer	S.W.	S.W.	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −12, $\frac{6}{18}$	S. −14, $\frac{6}{18}$	—
Holder-on (riveter)	—	—	$\frac{6}{60}$	$\frac{6}{36}$	In this case myopia of about 6 D. in right and 4 in left		—
,,	S.W.	S.W.	$\frac{6}{24}$	$\frac{6}{24}$	S. −3·5, C. −1, $\frac{6}{18}$	S. −4, $\frac{6}{9}$	—
Farmer	1 W.	2 O.	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −6, $\frac{6}{24}$	S. −5·0, C. −2, A. 155, $\frac{6}{24}$	—
Vanman	2·5 W.	2·5 W.	$\frac{6}{60}$	$\frac{6}{18}$	S. +1, C. +2·5, $\frac{6}{18}$	C. +3, A. 100, $\frac{6}{18}$	—
Joiner	1 A.	1 A.	$\frac{6}{36}$	$\frac{6}{12}$	S. +1, C. −1·5, A. 100, $\frac{6}{12}$	C. +1, A. 170, $\frac{6}{6}$	—
Colliery fireman	S.A.	S.A.	$< \frac{6}{60}$	$< \frac{6}{60}$	Myopia 16 D.	Myopia 16 D.	—
Fisherman	4 W.	2·5 W.	$< \frac{6}{60}$	$\frac{6}{60}$	Right not improved	S. −1, C. +2, A. 90, $\frac{6}{24}$	Corneal opacity in right.
Labourer	—	—	$\frac{6}{36}$	$\frac{6}{36}$	C. −3, A. 95, $\frac{6}{12}$	S. −1, C. −3, A. 90, $\frac{6}{12}$	—
Joiner (apprentice)	*nil*	*nil*	$\frac{6}{24}$	$\frac{6}{36}$	S. −2, $\frac{6}{12}$	S. −2, $\frac{6}{12}$	Nebula on each cornea.
Packer	3·5 W.	3·5 W.	$\frac{6}{24}$	$\frac{6}{24}$	C. +3·5, A. 105, $\frac{6}{18}$	C. +3·5, A. 85, $\frac{6}{18}$	—
Dock labourer	*nil*	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	Myopia 14 D.	Myopia 16 D.	Choroiditis in each. Works without glasses.
Coal merchant	*nil*	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −14, $\frac{6}{30}$	S. −12, $\frac{6}{24}$	—
Butcher	*nil*	1 W.	$\frac{6}{60}$	$\frac{6}{36}$	S. −5, $\frac{6}{18}$	S. −4, C. −1, A. 180, $\frac{6}{12}$	—
,,	2 W.	2 W.	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −8, C. −2, A. 70, $\frac{6}{30}$	S. −7·4, C. −2. A. 165, $\frac{6}{18}$	—
Baker	1 A.	0·5 A.	$< \frac{6}{60}$	$< \frac{6}{60}$	S. −7, C. −2, A. 90, $\frac{6}{12}$	S. −8, C. −1, A. 90, $\frac{6}{6}$	—
Dock labourer	*nil*	*nil*	$< \frac{6}{60}$	$\frac{6}{60}$	S. −4, $\frac{6}{12}$	S. −3, $\frac{6}{9}$	Has already served in the Army.

House painter .	—	—	$\frac{6}{9}$	$< \frac{6}{60}$	Not improved	—	Has always been practically blind in left, yet able to paint.
Saw miller . .	*nil*	*nil*	$\frac{6}{36}$	$\frac{6}{12}$	Improves to $\frac{6}{9}$	—	High hypermetropia in right. Practically man with only one useful eye.
Printer . .	2 A.	2 A.	$\frac{6}{36}$	$\frac{6}{60}$	S.—3·5, $\frac{6}{12}$	Not improved	Man with only one useful eye as printer.
Clerk . . .	S.A.	S.A.	$< \frac{6}{60}$	$< \frac{6}{60}$	S.—3·5, $\frac{6}{12}$	S.—3·5, C.—0·75, A. 90, $\frac{6}{9}$	—
Merchant . .	1 A.	S.A.	$\frac{6}{24}$	$\frac{6}{36}$	S.—2, C.—0·75, A. 90, $\frac{6}{6}$	S.—2, C.—0·75, A. 90, $\frac{6}{6}$	—
Spirit salesman .	1·5 W.	1 W.	$< \frac{6}{60}$	$\frac{6}{60}$	S.—4, C.—1·5, A. 165, $\frac{6}{12}$	S. -2, C.—1, A. 15, $\frac{6}{9}$	—
Blacksmith .	2·5 W.	S.W.	$\frac{6}{36}$	$\frac{6}{9}$	S.—1, C.—2·5, A. 30, $\frac{6}{9}$	Practically emmetropic	—
Sorting clerk .	2·5 W.	*nil*	$\frac{6}{24}$	$\frac{6}{9}$	S.—1, C.—2·25, A. 10, $\frac{6}{12}$	,, ,,	—
Carter . . .	3 A.	2 A.	$\frac{6}{24}$	$\frac{6}{24}$	C.+3, A. 180, $\frac{6}{9}$	C.+2, A. 180, $\frac{6}{9}$,,	Has extreme congenital nystagmus.
Labourer . .	*nil*	*nil*	$< \frac{6}{60}$	$< \frac{6}{60}$	S.—10, $\frac{6}{24}$	S.—14, $\frac{6}{24}$	—
Carter . . .	S.W.	S.W.	$< \frac{6}{60}$	$\frac{6}{36}$	S.+5·0, $\frac{6}{18}$	S.+5·0, $\frac{6}{18}$	—
Grocer's assistant	S.W.	2·5 W.	$\frac{6}{24}$	$\frac{6}{18}$	C.+4, A. 105. $\frac{6}{9}$	C.—2, A. 75, $\frac{6}{9}$	—
Clerk . . .	2 W.	1 W.	$\frac{6}{60}$	$\frac{6}{6}$	C.+2, A. 95, $\frac{6}{18}$	Not improved	—
Pithead worker .	2 W.	2·5 W.	$< \frac{6}{60}$	$< \frac{6}{60}$	C.—2, A. 180, $\frac{6}{36}$	C.—2, A. 180, $\frac{6}{36}$	Albino, as are also two brothers.
—	2 W.	1 W.	$\frac{6}{60}$	$\frac{6}{60}$	S.—14, C.—1·5, A. 15, $\frac{6}{18}$	S.—14, C.—1·5, A. 20, $\frac{6}{18}$	—
Buffer . . .	3·5 W.	3·5 W.	$\frac{6}{60}$	$\frac{6}{24}$	C.—3·5, A. 10, $\frac{6}{18}$	C.—3·5, A. 10, $\frac{6}{9}$	—
Spirit salesman .	—	—	$\frac{6}{12}$	*nil*	—	—	Extensive changes in macula of left.
Van driver . .	1 W.	S.A.	$\frac{6}{36}$	$\frac{6}{36}$	S.—3, C.—0·75, A. 180, $\frac{6}{9}$	S.—3·5, C.—0·75, A. 90, $\frac{6}{9}$	—
Dock labourer .	S.W.	S.W.	$\frac{6}{36}$	$\frac{6}{60}$	Not improved	Not improved	Optic nerve atrophy in both.
Joiner . . .	—	—	$\frac{6}{6}$	$\frac{6}{6}$	Blind	Emmetropic	—
Seaman . .	1·5 A.	1·5 A.	$\frac{6}{24}$	$\frac{6}{24}$	S.—1, C.—1, A. 90, $\frac{6}{12}$	C.—2, A. 80, $\frac{6}{18}$	—
Student (engineering)	*nil*	*nil*	$\frac{6}{60}$	$\frac{6}{60}$	S.—3, $\frac{6}{6}$	S.—3, $\frac{6}{6}$	—
Rivet maker .	S.W.	S.W.	$< \frac{6}{60}$	$\frac{6}{60}$	Practically blind	S.—5·0, $\frac{6}{18}$	—
Grocer . . .	*nil*	1·5 O.	$\frac{6}{12}$	$\frac{6}{36}$	S.—1, $\frac{6}{5}$	C.—1·5, A. 60, $\frac{6}{6}$	—
Insurance manager	1 W.	1 W.	$< \frac{6}{60}$	$< \frac{6}{60}$	S.—8, C.—1, A. 180, $\frac{6}{6}$	S.—9, C.—1, A. 170, $\frac{6}{9}$	—
Scavenger . .	—	—	$\frac{6}{24}$	$< \frac{6}{60}$	—	Practically blind	Strabismus in left.
Labourer . .	2·5 W.	2·5 W.	$\frac{6}{36}$	$\frac{6}{18}$	S.—1·5, C.+2·5, A. 105, $\frac{6}{12}$	C.+2·5, A. 75, $\frac{6}{9}$	—
Dairyman . .	S.W.	S.W.	$< \frac{6}{60}$	*nil*	High myopia, not improved	Practically blind	Left lens removed for cataract.

Occupation.	Opthalmometer readings.		Vision without glasses.		Correction and vision obtained.		Remarks.
	R.	L.	R.	L.	R.	L.	
Clerk	S.A.	*nil*	$\frac{6}{36}$	$\frac{6}{36}$	S.−2·75, O.−0·5, A.90, $\frac{6}{6}$	S.−2·5, $\frac{6}{6}$	—
Weaver	—	—	$\frac{6}{60}$	$\frac{6}{60}$	—	—	Opacity on posterior surface of each lens, with vitreous opacities.
Engine attendant	3·5W.	3·5 W.	$\frac{6}{36}$	$\frac{6}{36}$	C.+3, A. 100, $\frac{6}{18}$	C.+3, A. 100, $\frac{6}{18}$	—
Blacksmith	*nil*	*nil*	$<\frac{6}{60}$	$\frac{6}{60}$	Not improved	S.−4, $\frac{6}{6}$	Right practically blind.
Carter	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.+6, $\frac{6}{6}$	S.+6, $\frac{6}{12}$	—
Labourer	*nil*	*nil*	*nil*	$\frac{6}{12}$	—	—	Left eye practically blind from choroiditis.
Chemist	3 W.	3 W.	$\frac{6}{36}$	$\frac{6}{36}$	C.−2·5, A. 1·0, $\frac{6}{12}$	C.−2·5, A. 10, $\frac{6}{12}$	—
Vanman	S.W.	1·5 W.	$\frac{6}{60}$	$\frac{6}{18}$	No improvement	C.−1·5, A. 150, $\frac{6}{12}$	Macular disease in right.
Warehouseman	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−18, $\frac{6}{36}$	S.−10, $\frac{6}{24}$	—
Clothing salesman	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−14, $\frac{6}{24}$	S.−14, $\frac{6}{18}$	—
Dock labourer	S.A.	S.O.	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−3·5, C.−0·75, A.90, $\frac{6}{4}$	S.−3, C.−0·75, A.60, $\frac{6}{12}$	—
Saddler	*nil*	1·5 W.	$\frac{6}{60}$	$\frac{6}{60}$	S.−10, $\frac{6}{12}$	S.−8, C.−1·5, A. 180, $\frac{6}{12}$	—
Street repairer	1·5 W.	1·5 W.	$\frac{6}{24}$	$\frac{6}{60}$	S.−3, C.−1·5, A. 170, $\frac{6}{12}$	S.−16, C.−1·5, A.170, $\frac{6}{24}$	—
Motor driver	1 W.	1 W.	$<\frac{6}{60}$	$\frac{6}{60}$	No improvement	S.−7, $\frac{6}{12}$	Cataract in right.
House painter	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.−4, $\frac{6}{6}$	S.−4, $\frac{6}{6}$	—
Storeman	*nil*	*nil*	$<\frac{6}{60}$	$<\frac{6}{60}$	S.+6, $\frac{6}{18}$	S.+6, $\frac{6}{18}$	—
Law clerk	S.A.	0·5 A.	$\frac{6}{36}$	$\frac{6}{36}$	S.−2, C.−0·5, A. 90, $\frac{6}{6}$	S.−2, C.−1·25, A. 90, $\frac{6}{6}$	—
Chauffeur	*nil*	1 W.	$\frac{6}{9}$	$<\frac{6}{60}$	—	No improvement	Very high myopia in left.
Leather salesman	*nil*	*nil*	$<\frac{6}{60}$	$\frac{6}{36}$	No improvement	S.+4, $\frac{6}{6}$	Extreme hypermetropia in left.
Baker	—	—	$\frac{6}{9}$	—	—	Left eye practically blind	Had squint in left in childhood.
Shipyard labourer	irreg.	irreg.	$<\frac{6}{60}$	$<\frac{6}{60}$	No improvement	No improvement	Nebula on each cornea, result of ulceration.
Warehouseman	S.W.	S.W.	$\frac{6}{36}$	$\frac{6}{36}$	S.−1, $\frac{6}{6}$	S.−1, $\frac{6}{6}$	—
Railway porter	1 W.	3 W.	$\frac{6}{60}$	$\frac{6}{60}$	S.−6, $\frac{6}{24}$. Does not take C.	S.−1, C.−3, A. 180, $\frac{6}{18}$	—
Mercantile clerk	1·5 W.	—	$\frac{6}{36}$	—	C.−1·5, A. 20, $\frac{6}{18}$	—	Left eye blind for many years.
Stationer	S.W.	S.W.	$\frac{6}{18}$	$<\frac{6}{60}$	S.+3, $\frac{6}{6}$	No improvement	Squint of left.

N.B.—With exception of the clerks almost all the above worked without glasses.

From the above tables it is apparent that men with very defective sight have worked at a large variety of occupations. It is right to remark that, with the exception of men employed in clerical work, scarcely a single man included in the above tables used glasses for his work. Thus we have chauffeurs, stokers, carters, labourers, hammermen, with extremely defective vision, in many cases with only one useful eye, working quite comfortably without glasses.

It is to be noted that the following conventions apply to the above tables. In the table of ophthalmometric readings "A." stands for against; in the tables for corrections "A." stands for axis. In the tables for ophthalmometric readings "W." stands for with; "I." for irregular; "O." for oblique. "S." in the ophthalmometric tables stands for slightly; in the tables for corrections it stands for spherical, and "C." in these last-mentioned tables for cylindrical.

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4. *Suggested clinical tests of the threshold of light and colour.*

By George Young.

Several years ago it struck me that I, personally, at all events, had somewhat neglected the investigation of light- and colour-sense, while much time was devoted to the form-sense. I do not think the form-sense exists, as such, apart from the light-sense. There must be some differentiation of an object from its background in order for it to be perceived. We see this in animal mimicry and *camouflage*. Our consultations take up much time, and I thought if I could form some method of investigating thresholds, one which could be carried out with accuracy as well as speed, it would be an advantage, because all have not the time to go through what may be called laboratory tests. Years ago I tried

all kinds of fabrics, and eventually I found that the simplest way was to take standard inks and form definite dilutions with distilled water. I took Indian ink, vermilion, emerald, ultramarine, and yellow, and made definite graded dilutions from full strength to 1 in 1024. I dropped these on blotting-paper squares which I pasted into the pages of an album, which I show you, and turned the leaves rapidly in the patient's view. I am not in a position to make positive statements as to the value of the method; it is only a suggestion, but it only takes a minute to do. In a case of retinitis of pregnancy yellow was very much reduced, namely, to 4. In early glaucoma the light-sense was very much affected, while the colours were not. In advanced atrophy it was not, but the colours were. It is significant, at all events, that great changes in the threshold are met with. I was asked to say a few words at Oxford on the subject. I did so reluctantly, because I do not think there has yet been enough done in the investigation. Some speakers suggested that we should have the test universal, so that all could try it. I have standardised it, but I have only just received the tests, as standardised, and have not had the opportunity of working the matter out on principles—perhaps fortunately, because we can now all do so. Perhaps, later, when others have tried it, we can have a general discussion. The desiderata I had in mind were rapidity and exactitude. For consulting practice I think this album gives a rapid clue. It gives the approximate thresholds. The test is done just after taking the form-sense. The patient is asked if he sees blank or a spot, and one turns the leaves of the album until he sees a spot. Each eye is separately tested. I show here a twin disc used on a revolving table. One can find, by this means, the absolute threshold for colour and for light. The album is an exceedingly useful test for tobacco amblyopia, and it is very quick. The patient can at once discern a spot he is not looking at. It also detects small central

scotomata, because the surgeon can recede as far as he likes. Reduction of the illumination makes no difference to the test of the threshold, which is plausible, because both the object and the background are equally reduced as regards light. I shall hope that others will bring forward clinical evidence.

Dr. W. W. Sinclair said he had had a slight experience with the album test. He found that its chief charm was its simplicity and rapidity; one could run through the colours and shades very quickly. That was quite apart from the value of the results obtained, which he thought might prove in the future to be of diagnostic as well as of prognostic importance. As a means of detecting central scotomata, the album was the best thing he had encountered. A patient with central scotoma always noticed spontaneously that while he could not see the spot on the page he was looking at, he could see the spot on the opposite page. In a recent case of cataract he found, in the worst eye, a central scotoma for normal colours and light perception, but a full field for white. On carefully looking with the electric ophthalmoscope through the half-opaque lens, he detected a patch of macular disease. The better eye also had a full field, and on testing with the album the colour threshold was found to be 2° to $3\frac{1}{2}$° below the normal, especially for yellow. He tested this eye for central scotoma with the album, and she at once noticed there was a central scotoma for the finer shades, which seemed to indicate that the macula was suffering from a degenerative process in its early stage, although nothing could be seen with the ophthalmoscope. By testing in this way with faint colours, one could get a demonstration of the existence of a central scotoma very quickly. He had found a remarkable defect for yellow in certain forms of retinitis, especially the albuminuric retinitis of pregnancy. Curiously, however, in the albuminuric retinitis seen in association with "trench nephritis" he

had tested for yellow and found it was extremely well seen. An explanation of this distinction between the two forms of retinitis was yet to be found.

Capt. WALLACE said that when making threshold tests what appeared to him a difficulty was the standardisation of the colours. He made very exact dilutions with water, and was able to carry them to a higher degree than Mr. Young had done, namely, up to 1 in 2048. For rapid diagnosis it was one of the most beautiful and rapid tests one could imagine. One got to know what was the characteristic of a particular affection of the fundus. It did not occupy a minute, and needed no knowledge on the part of the patient. A difficulty occurred inasmuch as no colourman could positively tell what was the equivalent of spectrum red or other primary spectrum colour. Bacteriological stains, however, provided a standard "zero," being so many milligrammes of the stain to a c.c. of water. The speaker used eosin for red, malachite green, orange G and methylene blue *plus* dahlia violet for blue.

Mr. YOUNG (in reply) agreed with Capt. Wallace that a standard of colour could not be established absolutely with any pigment. Spectral colours would have to be used. The only practical way was to take the inks of an individual maker, and to stick to one standard set of types for clinical comparisons and notation. Messrs. Weiss had assured him that the standards he had used in his album could be reproduced in future. He fully believed in the honesty of that promise.

5. *Note on the use of glare glasses.*

By G. MCPHERSON.

ANYONE proceeding on service to Egypt or Mesopotamia is no doubt told that glare glasses are an essential part of his outfit. I do not propose to discuss the effect of such glasses in the prevention of heat-stroke. I only

wish to record my experience of their use in certain cases that have come under my notice. From that experience I am forced to the conclusion that glare glasses are not altogether an unmixed blessing.

I observed many years ago in India that after using smoked glasses my eyes ached considerably, and hence I very soon discarded them. Since coming to Mesopotamia about fourteen months ago, about twelve cases have come under my notice in which officers have come complaining of headache and eyestrain where there was either no error of refraction, or the error was not sufficient to account for the condition. I advised the giving up of the glare glasses, and the result has been most marked in every case. I remember a colonel under whom I served complained to me that in the evenings his eyes felt tired and ached. I found he was wearing smoked glasses. The day after discarding them all his symptoms disappeared. He told me the change was so marked that he had not the slightest doubt that all his trouble arose from the use of the glasses. He was almost fifty-four years of age and had normal refraction. Within the last few days two officers, men about thirty years of age, have reported to me that after giving up the use of glare glasses their symptoms of eye-strain have quite disappeared. In every case the patient has been much struck by the result of giving up the glasses, and very grateful for the advice.

In most of the cases, so far as I remember, the glasses used were fairly deeply tinted. Some were smoked, some were dark green or blue, and some were amber-coloured. The point common to all was the depth of the colour. When people buy glare glasses they usually select a pair deeply tinted. There is no doubt a greater sense of restfulness to the eye from the deeper tinted glasses than from the lighter tinted ones. As regards the refraction of the cases, most have been either normal or slightly hypermetropic. The myope does not appear to suffer the same inconvenience.

I presume the dark glasses cause a certain amount

of dilatation of the pupil, and this in turn puts a greater strain on the accommodation, just as the presbyope and the hypermetrope have their initial difficulty in reading in the evenings.

In several of the cases, especially where the smoked glasses were used all day long, the pupils were abnormally dilated and were more sluggish in their reaction to light. The cases I refer to above were all officers. Several men have also complained to me of their eyes being strained after the use of their glare goggles, and have asked to be excused from wearing them. In the case of men one cannot rely so much on subjective symptoms as in the case of officers.

From my experience, therefore, I should advise the wearing of smoked glasses only under exceptional circumstances and not as a matter of routine, and then only moderately tinted glasses.

I am not aware whether the above observations have been published by anyone, as I have no access to ophthalmological records on field service. The relief of the symptoms of eye-strain was so marked that I feel my experience may prove useful to other ophthalmologists working in similar surroundings.

XIV. APPENDIX.

Ectopia lentis with a coloboma. Ptosis with malposition and limitation of movements of the eye. By D. V. Giri.

A reversible screen stereoscope. Congenital pigmentation of the retina. By A. C. Hudson.

A luminous type for estimating the light sense in night-blindness. By F. Moxon.

Museum.

Under the care of A. C. Hudson.

Sketch book of fundus oculi drawings, etc. Light threshold tests. G. Young.

Scotometer. P. Bardsley.

Scotometer. Thomson Henderson.

Scotometer. R. H. Elliot.

Portable perimeter. Brooksbank James.

Giant perimeter. Reversible screen stereoscope. A. C. Hudson.

Perimeter and scotometer. Priestley Smith.

Perimeter. R. R. Cruise.

Drawings illustrative of changes in the conjunctiva in inflammation. M. S. Mayou.

Sketches of fundus oculi. W. Wallace.

Models illustrating plastic operations, masks, etc. Derwent Wood.

Models of plastic operations. H. D. Gillies.

REPORT OF COUNCIL.

The Council is happy to report the continued prosperity of the Society.

During the session 1917–18, 13 new members have been elected, 2 have resigned, while the Council has to deplore the loss of 4 members by death. Dr. Laidlaw Purves was one of the small remaining group of original members; Dr. Kenneth Scott was a member for thirty years; Dr. Menteith Ogilvie served on the Council from 1910 to 1912; Dr. Sulzer, of Paris, was one of our Foreign Members.

The Society now has a membership of 506, with 7 Honorary Members.

The Fifth Annual Congress was held on May 3rd, 4th, and 5th, 1917, and was in every way successful. Thanks are due to the Committee of Management of the Royal London Ophthalmic Hospital in connection with the holding of the clinical meeting at their institution; to the Honorary Staff of the Hospital for the excellent arrangements for the comfort and convenience of members; and to the authorities of the Royal Society of Medicine for the efficient organisation of the meetings held in their rooms.

The Honorary Treasurer's report and statement of accounts are submitted. From this statement it will be seen that there is a balance in favour of the Society of £255 4*s*. 10*d*., which constitutes a financial record for the Society, and for which the Council's congratulations are due to the retiring Treasurer.

The Council is pleased to be able to report that the scheme mentioned in the last Report, whereby other

Ophthalmological Societies throughout the Empire may enter into affiliation with our Society, has matured during the year, with the result that the Oxford Ophthalmological and the Midland Ophthalmological Society have unanimously agreed to accept it, while negotiations are at present proceeding with the Ophthalmological Society of Egypt and the North of England Ophthalmological Society.

ACCOUNT OF THE RECEIPTS AND PAYMENTS
OF THE
OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM,
FOR THE YEAR ENDED APRIL, 1918.

Receipts.

1917–18.	£	s.	d.	£	s.	d.
To Subscriptions:						
Per Collector	132	4	8			
„ Bank	153	12	6			
	285	17	2			
Less Subscriptions returned	2	14	6			
				283	2	8
„ Dividends:						
East India Stock (half year)	7	6	8			
Ramsgate Corporation	11	9	6			
London County Council (Nettleship Prize Fund)	6	15	0			
				25	11	2
„ Return of Income Tax				19	8	7
„ Sale of 'Transactions'				53	0	8
„ Messrs. Adlard on account of Damage by Fire				194	0	0
„ Contribution from President towards Cost of Illustrations				15	0	0
				£590	3	1

Payments.

1917–18.	£	s.	d.	£	s.	d.
By Adverse Balance from last account				15	7	5
„ Printing 'Transactions'	214	1	1			
„ Illustrations	48	8	3			
„ Sundry Printing	16	12	11			
				279	2	3
„ Reporting				11	17	0
„ Royal Society of Medicine				5	17	0
„ Collector:						
Salary	10	10	0			
Postages, etc.	2	6	6			
Honorarium	5	0	0			
				17	16	6
„ Surgical Secretary's Petty Cash				1	15	0
„ Medical „ „ „				0	15	0
„ 'British Journal of Ophthalmology' for advertising				1	16	0
„ Bank Charges				0	12	1
„ Balance in Bank				255	4	10
				£590	3	1

April 6th, 1918.

Examined and found correct, (*Signed*) L. J. Pisani, A. R. Brailey, } *Auditors.*

OXFORD OPHTHALMOLOGICAL CONGRESS, 1918.

ANNUAL MEETING HELD AT OXFORD ON JULY 11TH & 12TH.

Master: SYDNEY STEPHENSON.

Past Master: The Late R. W. DOYNE.

Deputy Master: P. H. ADAMS.

Hon. Treasurer: Sir ANDERSON CRITCHETT, Bart., C.V.O.

Hon. Secretary: BERNARD CRIDLAND.

REPORTS.

1. *Opening address.*

By SYDNEY STEPHENSON.

My first and most pleasant duty is to bid each and all of you a cordial welcome, and to thank you for your attendance in these strenuous times. It would be almost an impertinence to remind you that the keynotes of the Congress were those struck by the founder, Mr. Robert W. Doyne, namely, the cultivation of the spirit of good-fellowship and of unconventionality, the right of our youngest member to rank with his oldest colleague, and, last, but assuredly not least, the frank, free, and tolerant discussion of scientific matters brought before its gatherings. The friendliness of our meetings must have struck even the least observant.

As you know, the Congress is upon the point of becoming affiliated with the Ophthalmological Society of the United Kingdom—a momentous event to be finally settled at the general meeting arranged for this evening. It has been suggested that under the circumstances I should briefly outline the history of the Congress. Human memory is proverbially short, and the recollections of one generation are speedily expunged by those of the next. It is therefore important that the history of the Congress should be written while it is comparatively fresh in our minds. Unless this be done now it will in the course of a few brief years fade to nothing more substantial than a memory, albeit a very pleasant one, of our annual gatherings.

In July, 1904, the annual meeting of the British Medical Association was held at Oxford, and by a happy inspiration the members of the Section of Ophthalmology were lodged beneath the hospitable roof of Keble, where its scientific meetings were also held. The late Robert W. Doyne, then Margaret Ogilvie Reader in Ophthalmology in the University, presided over the Section, to which I had the honour to be one of the secretaries. The meetings were largely attended (not alone by our own countrymen), and were so successful, both scientifically and socially, that Mr. Doyne determined to perpetuate the happy result by inaugurating an annual meeting of ophthalmologists in Oxford. For several years he organised such a gathering, to which he invited every member of the Ophthalmological Society of the United Kingdom. Those who attended were lodged in Keble College; communications were read in the neighbouring Departments of Human Anatomy and Physiology; interesting cases were brought together at the Eye Hospital, where demonstrations of ophthalmic operations were given by men whose names were familiar as household words in the ears of the medical profession; and, lastly, parties were arranged to guide visitors to the Congress about the various colleges, and they were entertained upon the

river and elsewhere. Representatives of America and of the various continental countries came in considerable and ever-increasing numbers. In fact, almost from the first the meetings enjoyed something of an international character.

This plan was continued for several years. It is interesting to recall the fact that in 1908, on the suggestion of the late Sir H. R. Swanzy, an illuminated address and a service of plate were presented to the founder of the meetings, Mr. Doyne. In 1909, at a meeting held at Keble College on July 15th, it was determined to place upon a permanent footing the annual meeting at Oxford of those interested in ophthalmology. A resolution to that effect was proposed by myself, seconded by Dr. R. A. Reeve (of Toronto) and supported, among others, by Werner (Dublin), Walker (Glasgow), Coulter (Newport), Motais (Angers), Dufour (Lausanne), Wendell Reber (Philadelphia), and Vail (Cincinnati). It was carried without a dissentient voice. It was then proposed by Prof. Osler, seconded by F. M. Granger (Chester), and carried: "That the Oxford Ophthalmological Congress be and hereby is constituted." At the same meeting a provisional committee was appointed, with Mr. Doyne as chairman and myself as secretary. I may as well say that the motives that led me to propose the first resolution were that so valuable an institution as that originally conceived by Mr. Doyne should under no circumstances be allowed to lapse, and further, that the excessive burden of work and expense thrown by the former arrangement upon the broad and generous shoulders of that great and far-seeing man should be removed. The Congress, although organised upon somewhat autocratic principles, was conducted upon the lines that had proved themselves so successful in Mr. Doyne's original scheme. Although the rules might be absolute, the conduct of the meetings was democratic in the extreme, and to this factor no small part of the success of the Congress, in my opinion, is due. As was but right and fitting, Mr. Doyne was elected the

first master of the reorganised body, which owed its origin solely to his initiative, energy, and work. It remains with us to continue on the road so clearly mapped out by Mr. Doyne.

It only remains to add that some of the more important communications brought before the Congress have been published in the columns of the *Ophthalmoscope* and the *British Journal of Ophthalmology*. These include contributions by Nettleship, Lagrange, E. Treacher Collins, Sir Victor Horsley, Sir J. Mackenzie Davidson, Holth, Straub, Sir Almroth Wright, Gotch, Arthur Thomson, Risien Russell, James Taylor, F. E. Batten, Hawthorne, Priestley Smith, Marple, Reber, McReynolds Whitnall, Critchett, Jessop, Coats, Darier, Pooley, Jameson Evans, T. Harrison Butler, Elliot, Cridland, van Lint, and Morax, to mention a few only of the well-known names of men who have added to the scientific lustre of the Congress. The more or less formal discussions have included those dealing with miners' nystagmus, the present position of ophthalmology, the Workmen's Compensation Act, and industrial diseases and accidents.

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2. *The Doyne Memorial Lecture.—Ophthalmology and the War.*

By Sir William Collins.

I am here to-day in dutiful obedience to an imperious summons received some months ago from your vigilant hon. secretary commanding me to open the proceedings of your Congress, and at the same time doing me the favour to select the subject upon which I was to be privileged to address you.

As I am accordingly neither responsible for the orator nor for the subject of his oration, I claim to be acquitted alike of the presumption of playing the part for which I have been involuntarily cast, and of megalomania in

addressing you on the ambitious topic of "Ophthalmology and the War."

As almost the last of the race of those who have combined the practice of general surgery with that of ophthalmic surgery, and as one who has also wandered into the dusty arena of public life in County Council and the Commons House of Parliament, I am afraid I am regarded as *anathema* by those orthodox and specifically-minded folk who cherish specialism by virtue of its exponent's innocence of knowledge, or practice, outside the confines of his own particular cult.

The late Dr. Billings, of New York, used facetiously to say, "A specialist should be a good general practitioner and something more—but he is very often something *else*." The truth of that saying—outside the pre-eminently scientific specialty of ophthalmology—is susceptible of abundant illustration. Yet none of us would desire so to circumscribe the perspective of our life's study as to emulate the lament of the grammarian, upon his death-bed, when he was heard to repine that instead of extending and exhausting his energies over the whole range of etymology, he had not exclusively and assiduously restricted himself to the study of the accusative case.

I am, any way, pleased and proud to be once again in dear old Oxford, to renew my acquaintance with many a hallowed spot no less than with its school of ophthalmology, the outcome of the devoted labour and far-seeing enterprise of one whom it was my high privilege to call my friend.

It is not possible to speak on ophthalmology in Oxford, and least of all at this Congress, without the vivid presence, in the mind's eye, of the kindly, thoughtful, cheery personality of Robert Walter Doyne. Emerson has well said, "An institution is the lengthened shadow of one man," and—while we do not forget the generous aid of others—when we recall the foundation and development of the Oxford Eye Hospital and of this Congress, the "one man" without whom these would not be what they

now are was my old colleague and friend, and—strange though it may seem to add—at one time pupil, R. W. Doyne. He was a doer and a thinker rather than a writer or compiler, and his work lives in the Hospital, the School, the Readership, and the Diploma rather than in countless contributions to ponderous tomes or ophthalmological transactions. His Keltic temperament sustained him amid many adversities, inspirited and inspired him to vanquish opposition and obscurantism with indomitable courage, and endeared him alike to crowds of patients and troops of friends. He was original without eccentricity, witty without flippancy, a specialist without narrowness, a man with a single-eyed purposiveness, yet richly endowed with a broad outlook upon life. His science and his profession have suffered deep deprivation by his death, while his friends deplore the void occasioned by the loss of so genial, generous, and lovable a soul.

Since the Congress last assembled, Mr. Menteith Ogilvie, so long and happily associated with Mr. Doyne in his hospital work, has also passed away. His name, through the bounty of his mother, is identified with the Readership, and he, like his chief, was a man of wide sympathy and refined and cultured taste.

It is the desire and aspiration of all well-wishers of the Oxford Ophthalmic Hospital and School that, despite these heavy losses, they may yet stand fast, and grow and flourish for ever.

It was at Mr. Doyne's request that in 1905 I delivered the inaugural address at one of the earliest of these gatherings, taking then for my subject the modest, limited, and even humdrum topic of "The Crystalline Lens in Health and in Cataract." I am, of course, unaware of what was in the minds of those responsible for the selection of the subject of this address, with the ample and audacious title, "Ophthalmology and the War," but a very brief reflection indicated to me various avenues by which so comprehensive a topic might conceivably be approached.

One might, for instance, by simple frontal attack, dilate on the manner and extent in and to which the war has enriched our knowledge or revised our views of ophthalmic physiology, pathology, surgery, and therapeutics; for it has undoubtedly enlarged our scope and deepened our insight in all these domains. One might usefully subdivide such investigation into: (1) The acquisition of new knowledge; (2) the correction or re-statement of former teaching; and (3) the indications for further research.

A not less interesting side-track of inquiry would be to reflect on the influence of the war in assessing values of national methods of dealing with scientific problems, such as those of applied biology, to which category medicine and surgery belong, and to discuss such influence upon the specialty with which we are most familiar and concerned. An attractive chapter in any such diversion would be an endeavour to make a more just assessment of the place and value of German research than that which obtained so widely, for at least a generation, prior to the outbreak of hostilities. One could dwell on its hyper-specialisation, its plagiarism, its fond pursuit of little game, its lack of breadth of philosophic insight, and its arrogance and assumption alike in discovery and finality, no less than on the homage too obsequiously paid to it, both here and in America, which rendered an encyclopædic appendix of German bibliographical references the indispensable accompaniment of any contribution to a learned society or to the columns of the medico-scientific press.

Yet another mode of flank attack to which thought inclines, when reflecting on the topic (for which I am in no way responsible), is to consider the effect of the war in extending and magnifying the sphere of the State—the operation of State control and management—its effects and results on the practice of medicine and surgery in general and upon ophthalmology in particular. Some may be disposed to think that the experience of the last four years of the invasion by the State of almost every

department of human activity has not been uniformly accompanied by such unmitigated success as to approve its continuance in time or its extension in area. Others, enamoured of State socialism, or Syndicalism, or gratified with the triumphs of Bolshevism, may favour the adoption of yet further measures under which the individual withers and the State is more and more. Yet others may hold that these governmental interventions are good if only they be entrusted to the esoteric few, whose expert acquirements should clothe their dictates with authority. Thus I noticed last year that an ophthalmological committee, which offered its services to the War Office and sought certain official information, was vouchsafed what was deemed an unsatisfactory and unsympathetic reply. More recently I observe that a movement has been initiated by those who hold that Government departments have dealt with ophthalmic questions "in a very inadequate fashion from the ophthalmologist's point of view," and who have accordingly assumed the self-imposed task of "supervising matters of ophthalmological interest arising in connection with public affairs."

I will not pursue this theme further than to remark that, as one who for more than a quarter of a century, both by precept and example, has urged that the medical man, and even the ophthalmic surgeon, should play his part in the councils of the nation (too often the preserve and happy hunting-ground of his fellow professional, the lawyer), I marvel more at the prolonged past apathy than at the recent newborn zeal. Participation by professional brethren in affairs of State has sometimes earned the jealous disapproval of colleagues who, while furtively seeking their aid, have lost no opportunity of deprecating their deviation from what they deem, or affect to deem, the orthodox rut of convention.

I will only add that in approaching Government departments I fear that professional men, like other devotees of reform, have often asked in vain because they have asked amiss. The pontifical expert is not always accepted at

his own valuation, either in courts of law or even in the High Court of Parliament.

Contemplating war with its destructive violence—"the combination," as John Bright once said, "of all the horrors, atrocities, crimes, and sufferings of which human nature on this globe is capable"—on the one hand, and the delicate organisation and mechanism of our most refined sense-organ on the other, one might reflect philosophically how far asunder as the poles are the two conceptions in thought, and that to discourse of the action and reaction of the one upon the other would seem to partake of the nature of a solecism.

Yet even in what, by courtesy, may be called civil life, the conclusions of affairs of honour and the settlement of domestic differences, together with the varied perils of industrial life, have familiarised us with the direct and indirect results of violence applied to the orbit, and to the precious jewel which it contains and in part protects.

Penetrating wounds of the orbit and cranium by weapons of war have been recorded from the earliest times—by the pencil of Homer, and, since his day, in poem and prose by the pen of many a less ready writer. Poetic licence has included accounts of the successful reposition of a completely extruded globe. The Barons Larrey and Dupuytren described and classified orbital fractures, while Delorme in 1890 reviewed military experience as recorded to that date. The boundless field for fresh observation and improved methods afforded by the present Armageddon has been richly availed of.

Records and results are finding their way, as separate and scattered articles or collected summaries, into periodical publications or the transactions of learned societies. A few monographs have appeared, but our French allies, with their genius for collation and generalisation, are to the fore, and the works of Félix Lagrange, of Bordeaux, afford examples of thoroughness,

thoughtfulness, and artistry which must compel admiration and excite our emulation.

War, then, summons the ophthalmologist to study the direct and indirect effects of force applied in various ways to the bony orbital box, to its precious contents, and to the parts adjacent thereto and connected therewith. Principles of dynamics, of vulnerability, and of pathogeny must be brought under review. Fireside pathology as against bedside observation is justly deprecated, and arm-chair philosophising is scorned by the laboratory hack, yet *à priori* reasoning upon the anatomy, physiology, and embryology of the parts concerned *does* facilitate comprehension of much that *à posteriori* examination has disclosed.

Consider, then, a globe of semi-aqueous, colloidal, and crystalloidal contents, compacted of triplex coating—fibrous, vascular, neuro-pigmentary—the latter of most complex structure and delicate sensibility. This same globe suspended or tethered by ligaments, and alike held and actuated by three-pair muscular straps, loosely packed around with oily areolar tissue, and stemmed to the brain at its postern pole by a stout nerve-stalk. Encased, except in front, with bony walls, of greater tenuity above and to the nasal side; in front dependent only on fibro-fleshy lids for protection and, except for their voluntary or reflex closure, exposed to about one-quarter or one-fifth of its surface (including the only pellucid area thereof) to the changes and chances of the outer world. Within this globe delicate lenticular and neuro-muscular mechanisms for securing camera-wise the focussing of luminiferous ether waves from objects of varying distance, so as to subserve the purposes of the noblest of our senses, whereby we may either hold converse with the fixed stars or read the latest *communiqué* from the seat of war.

Introduce in thought, or apply in actuality, to this peaceful and delicately adjusted orb and orbit the ruthless assault and battery of war and all that modern

warfare imports, and what a picture of havoc and disaster we are called upon to witness!

Gases, fluids, solids may be the media of the *noxa*. The air, by virtue of its compression or rarefaction, by so-called "windage" may occasion concussion, contusion, or commotion of the media, the coatings, the musculature or nervous apparatus of the eyes. Noxious gases, acting chemically or physically, cause chemosis, corneal or conjunctival inflammation or necrosis, and even deeper damage. Lacrymatory shells and liquid fire may be responsible for similar and more destructive results. Metallic bodies of iron, lead, copper, aluminium, nickel, whether as rifle bullets, shrapnel bullets, portions of shell-casing, fragments from bombs, grenades, trench mortars, "whiz-bangs," and other projectiles, or particles of stone, dirt, or clothing, or splinters of bone from fractured face or cranium (infected or uninfected) may be the peccant matter, which, either by the irritation of its physical presence, by its infectivity, or by the chemical action it sets up in transit or in fixation, may inflict injury, or entail disorder, on some portion or other of the globe, its appurtenances or neural connections.

My own war work in ophthalmology has been done chiefly at the King George V Hospital at Blackfriars; the Royal Eye Hospital, Southwark; the Hampstead General Hospital; and the Michie Hospital at Queen's Gate; while a short sojourn at the Front during the roughest days of the Battle of the Yser, in November, 1914, gave me some invaluable experiences at first hand.

Of the grosser lesions of the orbital region, such as those involving fracture of the bones of the face or cranium from rifle bullets, shrapnel bullets, or fragments of shell (so often miscalled "pieces of shrapnel"), I have seen a great variety. They may or may not be accompanied by damage or destruction, direct or indirect, of one or both globes. Moreover, it must be remembered that injury to the cranium, whether by penetrating wound or otherwise, may, by virtue of lesion to the mid or hind

brain, disturb, damage, or destroy vision, while orbit and globe remain intact.

The anatomy of the parts concerned must be borne in mind. Seven bones form one orbit and eleven form the two, by reason of the mesial contribution of the frontal, ethmoid, and sphenoid. The roof of the orbit is the thinnest part of the *basis cranii*, and the peril of thrust wounds in that locality has been often emphasised in civil practice. I recall a case which was nearly dismissed as trivial from the casualty room—so insignificant appeared to be the slight wound of the upper lid by the ferrule of cane—yet, after two days of delusive calm, encephalitis supervened, and a post-mortem revealed penetration of the orbital roof, fracture of the posterior clinoid process of the opposite side, and an infected trauma extending to the descending horn of the lateral ventricle, also of the opposite side.

Next to the frontal, the superior maxilla exposes the largest surface to the orbital cone, its antral roof providing the floor of that cavity and also safe conduct to the second division of the fifth nerve. I have seen optic atrophy follow paracentesis of the antrum from stab of the optic nerve consequent on transfixion of this bony lamina by the incautious operator.

The inner wall, especially where composed of the *os planum* of the ethmoid, is very vulnerable, and offers little resistance to an unspent projectile. Nevertheless, fracture of the orbital vault by *contre-coup* or irradiation is very rare.

The cases of bilateral, trans-orbital fracture (so-called "through-and-through"), recorded during the Napoleonic wars, and pictured by Sir Charles Bell in the College of Surgeons collection, have been terribly common, and Shakespeare's woeful reference to "the holes where eyes should be which pitifully disaster the cheeks" has in this war's experience received only too abundant illustration.

Either with or without destruction of the globe, and with or without fracture of the orbital walls, foreign

bodies of considerable magnitude have been located deeply within the orbit. It is surprising how large a foreign body an orbit can contain and conceal, and how large a missile may effect entrance through the interpalpebral fissure without any wound of the lids. I have extracted from the orbit shrapnel bullets and large fragments of shell-casing more than 20 mm. in diameter, sometimes situated very far back, or set into the walls of the cavity, requiring cautious manipulation in removal. Recently, without excising the globe or dividing any muscle, I was able to extract a fragment 18 mm. by 15 mm. by 9 mm. from the back of the orbit of a Seaforth Highlander.

I recall a case at the North-West London Hospital many years ago, in which I excised an eye smashed in a pot-house brawl through a tumbler being flung in the face of a woman. After removing the eye I put my finger into the socket, where I discovered, and extracted therefrom, the major portion of the base of the tumbler.

I have notes of a case of (1) Explosive bullet entering the right orbit (with destruction of globe) and making exit by the hard palate. (2) Entrance of piece of shell through the right temporal fossa, destroying the globe, and making exit at the inner canthus of the left eye without injury to the latter. (3) A bullet entering the left orbit and emerging below the right ear, with partial paralysis of the right facial. The left globe was unruptured, but had T. − 1 and hæmorrhage into retino-choroid and vitreous. Later there was much pigmentation of the retino-choroid with obvious rents therein below and around the disc, and scotoma of the upper and outer field. (4) A bullet wound, with entrance at the upper and outer wall of the left orbit, and exit below the right ear; hæmorrhage over and around left optic disc, with later pigmentation above and adjacent to the disc, with atrophy of the latter; loss of sensation of the areas supplied by the first and second divisions of the right fifth nerve, but no injury to the right eye or

to the right facial. (5) A bullet wound with entrance in right temporal region, with destruction of that globe and exit at the right inner canthus, with laceration of right upper lid and fragments of bone driven into the remains thereof. (6) A shell fragment entering at the glabella, leaving through the left upper lid, with left ptosis and a temporarily immobile, semi-dilated pupil. Clear media permitted a view of macular and peri-arterial effusion, with pale optic disc and tortuous veins. (7) A bullet wound, with entrance above right orbit and exit through left orbit, destroying left globe, traversing frontal sinus with consecutive anosmia; right fundus showed later choroido-retinal pigmentation, the result of contusion only; a pulsating area remained above left orbit, but no cerebral symptoms were manifested.

Turning to cases where the projectile enters but does not leave, I might quote a case where a very large splinter of shell entered by the right orbit and came to rest between the left angle of the jaw and the styloid process, the right eye being destroyed and the movements of the jaw restricted. A case of shrapnel bullet which entered by a lacerated wound of the left temple, causing fracture of the great wing of the sphenoid, and without rupturing the globe, causing atrophy of the optic nerve, with no perception of light. I found the bullet in the floor of the left orbit and removed it. I could cite many other cases in which the missile has entered by or near the orbit, and has either (1) remained in the orbit with or without the destruction of the globe, or (2) has come to rest in some part of the face or cranium beyond the confines of the orbit. Thus, a Canadian admitted to King George V Hospital three days after being wounded at Courcelette by a shell presented intense chemosis, proptosis, and fixation of globe. He showed an entrance wound $1\frac{1}{2}$ in. behind the left external angular process, with ecchymosed margins and subcutaneous clot and great tenderness around the orbit. The anterior chamber was full of blood, T.—2, and no perception of light. The

radiographer reported "large fragment of shell lying behind the eye in the orbital space, the posterior wall of the space being involved." After excising the eye, which was ruptured posteriorly, I found and extracted the large piece of shell as well as splinters of bone from the external and superior walls of the orbit. He made a good recovery. In another case I found a fragment set in the *os planum*, in another in the roof of the antrum. In another case the piece of shell entered in the left pre-auricular region; the external muscles of both eyes and the *levatores palpebrarum* were paralysed; pupillary action was good, so was the ciliary; the optic nerves were unaffected, and vision was J. 1 and J. 4. A radiogram located a metallic foreign body near the floor of the aqueduct of Sylvius, over the basi-sphenoid—*i. e.* near the nuclei of the third nerves. In yet another case a shell fragment entered the left orbit above the left globe, destroying it. There was also ptosis on the right side with mydriasis and third nerve palsy. The media were clear, and the papilla showed no change, but the eye was quite blind. X rays disclosed a metallic foreign body near the *sella turcica*, with probable retrobulbar damage not far from the chiasma. In yet another case a round bullet had entered the right orbit, destroying the globe, and rested near the posterior extremity of the cavernous sinus and apex of the petrous bone.

The concurrence of marked chemosis, proptosis, and fixation of the globe following a projectile wound in the neighbourhood of the orbit is highly suggestive of a foreign body within that cavity, and should call for prompt radiography with a view to localisation and appropriate treatment.

It is not by any means always prudent, as I pointed out as long ago as 1897,* when I first employed radiography for removing a bullet, to accept without interpretation radiographic appearances. It is not always easy even with its invaluable aid to be certain whether a

* *Lancet*, October 16th, 1897.

foreign body is within the orbit or outside it, or to be positive whether a foreign body within the orbit is within the globe or not. Loss of tension, coupled with a wound of the sclera or cornea, does not negative the possibility of there being also an exit wound of the globe, the foreign body having traversed the eye and come to rest in an extra-ocular, though intra-orbital, position. Of this I have had several instances. If the anterior surface of the cornea be marked by apposition of wire, a point 25 mm. behind it will generally indicate the posterior limit of the ocular wall in the radiogram.

Of foreign bodies within the eye and their results military experience affords immense variety. Even with iron and steel fragments the magnet is not uniformly successful either in diagnosis or treatment. I recall a case in which it failed either to discover or disturb a piece of iron in a farrier's eye derived, forsooth, from shoeing—for practice—a dead horse! The ring magnet of Mellinger is rapidly replacing that of Haab and achieving successful results.

One of the most quaint metallic foreign bodies I have recently encountered in an eye was a coil of wire, said to be fuse-wire, 35 mm. long, displayed by X rays in the shape of an erect sphygmographic curve. Like the fly in amber "the thing itself was neither rich nor rare; the wonder's how the devil it got there." Suppurative irido-cyclitis had been set up and I removed the eye.

Another class of projectile injury is that of the glancing or tangential blow to the globe, without rupture or penetration, to which I have incidentally referred. In such cases choroido-retinal rents, hæmorrhages, and effusions are apt to be found at the spot of impact, followed later by pigmentation, atrophy, or proliferation according to the depth, degree, or extent of the respective lesions of the two inner tunics of the globe.

Lastly, without touching the globe, concussion effects on the fundus oculi manifest themselves by macular and para-macular hæmorrhages and effusions and choroidal

ruptures and hæmorrhages, force in such cases being transmitted either by projectiles traversing adjacent facial bones or by aërial condensation and rarefaction.

Félix Lagrange, with the generalising instinct that characterises our logical French allies, has endeavoured in his work *Les Fractures de l'Orbite,* and in his more recent beautiful atlas, to correlate in the language of law the relations between these various types of trauma and their respective fundus lesions, supporting his contentions with many illustrative cases and fortifying them with physical arguments.

Lesions of the transparent media and of the uveal tract, in military practice, present but little differences from those encountered in civil experience. Irido-dialysis is common, and traumatic irideremia not infrequent. Traumatic cataracts have generally done well under treatment, even when their causation has not been free from septic infection. Transient nebulosities of the lens resulting from non-penetrating contusion are an interesting study. I remember a case I noted when I was house-surgeon to Mr. Power in 1882, and published at the time. Vossius in 1906 suggested they might in some cases be due to the forcible impact or stamping of the iris against the lens. The rarity of sympathetic ophthalmitis continues, notwithstanding Delorme's assertion, to be a marked feature alike in our own experience and that of our allies—so different from the story of earlier continental and American war records.

I have, indeed, met with one case in a military hospital, but it was consecutive upon a non-military accident to the other eye, viz., a sclero-corneal wound from a piece of iron struck off by hammering the heel of a boot. The nearest approach to sympathetic inflammation which I can recall having seen, following a military injury, was one in which a fragment of shell hit a man's own rifle, while he was sighting through a loop-hole, and ricocheted into his left eye. There was a macula in the left cornea, a small rosette-like opacity in the lens, and set into the margin of

the papilla was to be seen a metallic-like particle about half the size of the disc. Eight weeks later there was to be seen obvious papillœdema of the opposite side.

One case of tetanus following peppering of the cheek and eye and a sloughing wound into the nasal cavity came under my notice. It began insidiously with slight trismus, was of the late subacute variety known as Kopf-tetanus, and recovered.

The relation between trench nephritis, so-called, and retinitis albuminurica, independently of pre-existent renal degeneration, is still conjectural, though most observers will have recorded instances of temporary neuro-retinal effusions in unwounded soldiers associated with indefinite pyrexia and accompanied by albuminuria.

I have done a good many plastic operations for restoring or improving the appearance of the lids, or for closing "holes where eyes should be" but where prosthesis was impossible. In the case of a repatriated wounded Canadian who had been taken prisoner at Ypres, after performing two plastic operations in 1915 and closing sinuses into the orbit I contrived, with Mr. Eastgate's assistance, an artificial cheek and eye. This, put on with spectacles, was similar to a prosthetic appliance I employed in 1894 in a case in which I had removed the superior maxilla for sarcoma, and which I published with a plate in that year in the *Lancet*.

At Orpington and elsewhere excellent results, on similar lines, are now being daily effected. Operations for entropion, ectropion and symblepharon, for closing sinuses, deepening sockets by flaps, Thiersching, or epithelial inlays have afforded gratifying cosmetic advantages. For ectropion I have found the temporary union of the palpebral margins, as advocated by Bowman, and Snellen's methods, very serviceable. Besides the usual operations for paralytic or traumatic ptosis in the case of an excised eye, a useful trick is to affix to the glass eye just above the corneal limbus a small projecting ledge of clear glass so as to catch and hold up the upper lid. I have seen severe

blepharospasm following shell-shock, and in one case, after this had persisted for three months, it appeared to be cured in three days by applying blisters over the mastoids. For loss of the upper, outer, or lower margins of the orbits autogenous grafts from the right seventh or eighth costal cartilages have, in the hands of Morestin and others, been very successful, while grafts of adipose tissue from the buttock have also, though less satisfactorily, been employed to impart rotundity to the cheek and temple. The exhibition from the Ontario Hospital at the College of Surgeons is attractive; the wax-works of my artistic friend, Major Lessore, are realistic indeed, and may be said to have something of the Tussaud touch.

Trachoma has been not uncommon amongst those denizens of Egypt, India and China with whom it is endemic, and I have seen it in Maoris, despite their reputed immunity. Not a few trachomatous recruits from Britain and Ireland have passed into the Army, but serious infective spread, as in last century wars, has happily not occurred. Mustard gas and lacrymatory shells have been responsible for very severe conjunctival inflammation and chemosis, and in one or two cases I have found later on evidence of papillœdema, possibly from consecutive engorgement of contiguous lymphatic tracts.

Time does not suffice to dwell on the attractive problem of the relation between cerebral traumata and visual and ocular symptoms, on which so much light has been thrown by painstaking observations and chartings of fields. Gross lesions by missiles or bone fragments, or inflammatory results therefrom, or the consequences of bruised brain, apart from more indefinite molecular concussions, have afforded grounds for some revision of views on cerebral localisation. Hemianopia in its common or irregular, quadrantic or helicine forms, and scotomata in observed relationship to lesions of the hinder parts of the occipital lobes, have received much attention. The bilateral representation of the macular area, for which Gowers contended so strenuously, has been denied, and evidence adduced for

thinking that the projections of the visual fields from the retinal cups have, as it were, their concentric counterparts in the cortex of the posterior poles of the occipital lobes adjacent to the inion.

In the matter of training and education of the blind and their capacity for self-support in the labour market, without charity and despite affliction, a new era has been opened through the beneficent activities centred at St. Dunstan's.

The standards of vision required of recruits were changed in September, 1915, and the new standards then fixed by the Army Council, stated to be "for the duration of the war," have again been varied, I think, in February, 1917. Much misunderstanding has arisen, and the present revised standards, both in regard to acuity and range of dioptric correction permissible, leave something to be desired.

It is thirty years since I contributed a paper to the Royal London Ophthalmic Hospital's *Reports* entitled "The Asthenopia of Neurasthenics," and among the shell-shock cases and other forms of neurasthenia with which war has familiarised us in such number and variety, I have found abundant illustration and confirmation of the views I recorded nearly a generation ago.

I said: "The term asthenopia, like similar terms framed upon the same pattern, is liable to a vast amount of abuse. It is often sufficiently mysterious to mislead, and sufficiently ambiguous to fail to explain. It was the refuge of the destitute before the time of Donders; it was the *hebetudo visus* of Jungken, the *disposition à la fatigue des yeux* of Bonnet. Donders showed that 'hypermetropia is usually at the bottom of asthenopia'; he went further, and declared that 'in the pure form of asthenopia hypermetropia is scarcely ever wanting.' Doubts to the contrary he silenced by demonstrating a latent hypermetropia where the manifest alone had been sought for and not found." Donders appeared nevertheless to admit that accommodative asthenopia could occur in the absence of refractive error. I then expressed the view that "varying degrees

of accommodative asthenopia are far more common than were then (1889) generally supposed, more especially in the class of persons whom medical nomenclature affects to designate neurasthenics. Persons of either sex of less than middle age constantly present themselves whose complaints of asthenopia are both bitter and persistent. In such hypermetropia may have been sought for and only a small defect discovered and accurately corrected, or none is present, or a slight astigmatism is neutralised; yet the symptoms remain unrelieved, and prolonged close work is impossible, so great is the discomfort. Such patients, though often exhibiting wide diversities of individuality, yet fall into the same class; they have been over-taxed mentally or physically, or both."

That description, I submit, may be applied literally to the classes of so-called shell-shock neurasthenics so familiar to-day, and in whose cases asthenopia is not only a prominent symptom, but the relief of whose eye-strain exercises a most potent and pleasing influence upon the amelioration and cure of their neurasthenia.

I quoted Weir Mitchell's book on *Fat and Blood, and how to make them,* to corroborate the contention that even small refractive errors are "competent mischief-makers when the brain becomes 'sensitised' by disease."

I cited a series of cases from my note-books to show that in young adults thus afflicted, apart from accommodative strain dependent on refractive error, there was considerable reduction in the amplitude of ciliary power which should obtain at such ages, and remarked that in the "asthenopia of neurasthenics" there is probably "faulty blood metabolism and consequent neuro-muscular debility, and it would seem that unstriped muscle suffers seriously from defective hæmo-poiesis, the heart and arterial muscles exhibit lack of tone, the pulse is soft, often irregular, and palpitation is common; the muscular fibre of the intestine suffers, and chronic constipation is a frequent concomitant; the ciliary muscle, with or without associated affection of the iris, is similarly weakened

and the amplitude of accommodation is thus seriously restricted. The treatment of such cases is happily hopeful and uniformly successful."

The accurate correction of even minute errors of refraction, spherical or meridional, and consecutive relief of accommodative over-activity or insufficiency in shell-shock neurasthenia, are attended with beneficial results of the most striking description. Mr. Harwood, our Resident Ophthalmic Officer at King George V. Hospital, has been unsparing in his devotion to the study of such cases, and has exhibited great ingenuity in their correction and treatment. The ciliary muscle is perhaps more constantly and unremittingly in action than any other muscle in the body during waking hours; its subservience to the most refined of our senses and judgments brings it into close correlation with mental states. The combined psychic and physical stress of modern warfare, with or without wounds and loss of blood, is just the kind of influence calculated to strain, exhaust or disturb this delicate musculature, and thus a new or added significance has during the last four years been imparted to what I long since described as the "asthenopia of neurasthenics." In this, as in so many other directions, war experience has helped to deepen and widen knowledge previously acquired.

Those who have traced the history of our craft, together with its ancillary services for the relief of suffering mankind, have usually dwelt on three great *momenta* which through the centuries have impelled its progress and improved its methods: *Religion*, *War*, *Science*. In days of peace we have beguiled our leisure with the futile conflicts of the first and third of these—*Religion* and *Science*—less bitter and noisy perhaps this century than last, as materialism has yielded to idealism.

It is indeed a blessed paradox that *War*, as well as *Religion* and *Science*, should contribute its quota, and an abundant one, towards the advancement of medical knowledge and the betterment of surgical treatment, to the

prevention of ills to which our flesh is heir, as well as to the relief of suffering of which it is itself so potent and prodigal a cause.

"A wise physician skilled our wounds to heal *is* more than armies to the public weal."

The British school of ophthalmology, like British medicine and surgery generally, has made use of its opportunities, alike in times of war and in times of peace, for widening its range and improving its methods. For sanity of judgment, dexterity in operation and humanity of sentiment it can challenge comparison with the self-complacent and arrogant schools of Vienna and Berlin, while nevertheless recognising that the empire of science and the republic of letters acknowledge no nationality and respect no frontiers. The Temple of Health, with its vestibules of medicine and surgery, needs many hands in many ages and various arts from different climes to complete and adorn it, yet in the raising of that stately pile each one of us may try to play a humble part :

"The Greek, the Roman, reared its ancient walls,
The silent Arab arched its mystic halls;
In that fair niche, by countless billows laved,
Trace the deep lines that Sydenham engraved;
On yon broad front that breasts the surging swell
Mark where the pond'rous sledge of Hunter fell;
By that square buttress look where Bowman stands,
The stone yet warm from his uplifted hands;
Then say, O Science! Shall thy life-blood freeze
When fluttering folly flaps on walls like these?"

Lt.-Col. R. H. Elliot thanked Sir William Collins for his valuable paper. He wished to endorse what Sir William Collins had said on the subject of asthenopia amongst the sick and wounded, and all the more so because the suggestion had recently been made that it was a waste of time fitting these men with glasses for such a short time as they needed them for. In his opinion no time was wasted that was spent on making the

convalescence of our sick and wounded easier and more happy. He called attention to the large number of women and girls who were now presenting themselves with asthenopic symptoms, as a result of the way in which the women of the nation had shouldered the burdens of men called out to fight for the country. He thought that the present difficulty in getting artificial eyes was one which required very firm handling, if it were true, as he had been informed it was, that some at least of those who had the secrets of the art were holding back from teaching their methods, with a view to keeping the trade in their own hands after the war. He thought that the question of quinine poisoning required careful watching by ophthalmologists, in view of the large doses of quinine that were being administered to our troops stationed in, or recently returned from, malarious areas. He had found that the anxiety, sorrow and nerve-shock which had eventuated from the war had been the starting-point of a great deal of ophthalmic disease, and not merely of glaucoma ; thus he had seen cases of cataract, and of many diverse inflammatory conditions, in which the histories appeared to show that the lowering of the patient's resistance which followed the strain of anxiety, or the shock of bereavement, had paved the way for the onset of disease. He thought that one of the great evils in our conduct of the war had been the tendency to criticise other people's work instead of doing our own to the best of our ability. It was up to us both as individuals and as a body of ophthalmic surgeons to see to it that when the day comes in which the Germans will ask to be taken back into the comity of nations, they shall be told that they have forfeited all such rights for a quarter of a century to come. All German names have been deleted from the Council of the Oxford Congress, but that should be looked on merely as a preliminary step. This was no hasty or ill-considered cry for vengeance, but a deliberate result of the weighing of all the sorrow and suffering which this dastardly, unnecessary and

deliberately provoked war has brought in its train. On the other hand, he urged that we should do all that lay in our power to cement the bonds of friendship between ourselves and those who are fighting with us, and especially those of them who share the birthright of our mother tongue. As one who had spent long years away from Britain, he thought he appreciated better than many stay-at-home Britishers the passionate love and pride of the colonies for the Motherland. He knew that many of the colonials resented the cool treatment they receive over here, and he called for a widening of the Oxford Congress spirit, that should make these men feel they were bone of our bone and flesh of our flesh. That was the great world-movement going on within the Empire, and the ophthalmologist should take his share, and his full share, in it. Lastly, he spoke of America, of her great and epoch-making act in throwing her sword into the scale when all looked blackest for the cause of freedom, of the modesty with which American surgeons came to this land to learn, of the great welcome they gave to those few who returned the compliment by crossing the ocean to see what was being done on the other side, and of the great future that lay before ophthalmology on the western shores of the Atlantic. We must see to it that one of the results of this war should be a close union of the peoples who speak the Anglo-Saxon tongue, wherever they may be found. God's super-man was not the force-worshipping Teuton, but the Anglo-Saxon, no matter from what shore he comes, with his respect for his plighted word, with his chivalrous championship of the weak and the oppressed, and with his fearlessness of the consequences so long as he is doing that which he believes to be right. We, as ophthalmologists, should do our little utmost to promote such a union. The British ophthalmologist who did not take in and study *The American Journal of Ophthalmology* was an incomplete surgeon. The man who worked in his own rut, and never went to see what others were doing, was failing to get the best out of himself.

He would make them a concrete proposal: When the war was over the Oxford Congress should organise a deputation, the larger the better, to cross the Atlantic and ask permission to be received at the meeting of the American Medical Association. The welcome they would receive would be immense, and the good such an act would do would be past computing. These would be of the lilies which grow on the dunghill of war.

Capt. Stack classified "socket work" into five categories:

(1) Good sockets: For these he mentioned a few devices to overcome poor effects with glass eyes—such as a faint tint when there is a slight disfigurement in the lids or eye, and the advantage of a plus or minus lens to give a larger or smaller appearance to the eye, and a prism to alter its apparent position.

(2) Sockets requiring special eyes: The eye which most nearly fits is built up with pink dental wax till it sets properly, then worn for a day or two, and the amended eye sent to the makers.

(3) Sockets which require operation: (*a*) Cicatrices—Thiersch graft. First remove the scar, leaving the conjunctiva; next sew the eyelids wide open; finally, put on graft. (*b*) Loss of sulcus—Esser graft. It is unnecessary to sew the skin to the stent; simply roll it round, letting it overlap itself. After removal of the buried stent, what he calls a "surface stent" is applied; this fills up the whole socket, extending into the new sulcus, and covers both eyelids; it is all one piece, and is removed daily for washing. (*c*) This surface stent is also very useful for grafting a new sulcus from within the conjunctiva without a buried stent; it is less of an operation and saves time; he passed round various surface and buried stents. (*d*) Ptosis. He referred to the difficulty of getting a satisfactory result in these cases.

(4) Sockets requiring a cartilage graft; Too large sockets require a buried graft behind the glass eye; orbits with defective walls require building up to improve the

contour of the face, and sometimes even enabling the socket to wear an eye.

(5) Hopeless sockets and adjacent injuries: These may require a mask. He thought the beautiful work of Derwent Wood too elaborate for the mass of cases. He had made experiments with a number of different substances with the idea of getting a simple and efficient mask. The dummy head shown was fitted with one made of glue and chalk with a basis of wool fabric and strengthened with thin, hard bits of steel. It could be fastened in place by a narrow steel telephone band or a pair of spectacles, the junctions obliterated with a little nose paste and touched up with grease paint.

He hoped that ophthalmic surgeons would keep in touch with these cases, and endeavour to direct the instrument makers to the simplest possible apparatus which could easily be adjusted and repaired.

Miss M. Gilchrist said that if the experience of the war had taught us nothing else, it had taught us that we must look after the interests of our great military and industrial armies better.

Referring to the question of intending candidates for Commissions in the Royal Navy, she asked for information as to the effect of refraction errors upon their future, and especially with regard to the possibility of the development of myopia—a condition on which it was not always easy to give a prognosis to the parents.

Mr. Harrison Butler said that he proposed to confine his remarks to the question of plastic surgery, because that was the only branch of war work in which he had had any special experience. Since hearing Major Gillies' paper,* he had used the Esser grafting method in about a dozen cases, and had naturally met with the difficulties which always trouble the beginner. He thought that dental moulding-wax was better than stent; it was softer, and more easily moulded to the shape required. Unfortunately, neither of these substances can be boiled. The

* See p. 70.

stent can be heated to a sufficient temperature to make it aseptic, but not so the wax, which immediately melts in hot water. He thought that placing it in a strong watery solution of binoxide of mercury after it had been moulded to the required shape rendered it sufficiently aseptic, because, being wrapped up in epidermis, any germs which escaped damage by the disinfectant would be shut in out of harm's way. Absolute asepsis was not possible in operations of this nature, but fortunately the face was very tolerant, and with ordinary care the results were always good.

He wondered whether it was always necessary to sew the epidermal graft round the mould. He thought that it was often sufficient to wrap it round the wax and place it in the skin cavity. The stitches generally sloughed out after two or three days, but this seemed to be sufficient for the purpose of allowing the graft to adhere. He wondered whether the cosmetic result obtained from these cases would compare valuably with that obtained from an ordinary whole skin-graft, and feared that there would always be a slight depression at the seat of operation. It was quite certain that neither of these methods should be employed when a pedunculated flap was used, because the results obtained with the flap were far more beautiful and more rapidly gained. He imagined that the Esser method would prove to be more valuable as an inlay than as an outlay, and he had already been able to deal with contracted sockets, which would have been impossible with the older methods. The graft had undoubtedly enormous possibilities in this connection. He had not been successful so far with introducing these inlays from outside, as there seems to be a strong tendency for them to become outlays. It seemed to him far more satisfactory to introduce the stent from the socket side, and sew the conjunctiva over it. In cutting the graft from the forearm it was essential to flex the arm. If the arm were kept extended the muscles become prominent, and it was then impossible to get a large graft without going too deep.

Capt. P. H. Adams said that he had great difficulty

in persuading soldiers, both officers and men, to wear spectacles, even for the relief of severe headaches and neurasthenia.

There was a hospital in Oxford for the treatment of malaria cases at which very large doses of quinine were given, but so far he had seen no harm result to the eyes in consequence. He had seen one case of so-called quinine poisoning in an officer, who had had quinine injected whilst unconscious. When he came to himself he was blind, but now, nine months later, he had recovered his central vision, though the fields remained small.

He would like to ask what was the opinion held with regard to the provision of spectacles to pilots in the R.A.F. The men were now passed as pilots with subnormal vision and told to get glasses. He should think it was extremely risky to put these men into astigmatic glasses and send them up in an aeroplane, unless they had worn them constantly on the ground for about two months, to become thoroughly accustomed to them. He should think they would be much safer with the error they were accustomed to, uncorrected. He had already heard of a case in which an officer crashed and eventually nearly killed himself landing, after undergoing treatment for muscular imbalance, never having had any trouble previously.

With regard to grafting, his experience was small compared with many, but he would like to put in a word for the whole-piece graft, taken from the inner side of the arm or thigh. These grafts grew very well, and caused no further scarring of the face, and he had been much pleased with the results obtained.

Capt. Percival J. Hay said that with regard to Esser skin-grafts, he considered it was better to introduce the inlay from without through the skin rather than from within through the conjunctiva, as asepsis was more likely to be insured. He thought it was necessary to stitch the skin-graft over the wax, as otherwise by shrinkage it might fail to unite.

It was an important thing to subject the patient before operation to a long treatment by massage and hot air, especially in the case of burns and bad explosions, for by these means much elasticity of the skin was restored.

He considered that it was better, because of the large flat surface offered, to take the grafts from the thigh than from the arm.

With reference to the question of the soldier wearing glasses, he had noted that a very large number of recruits who had been prescribed glasses at school did not wear them after leaving, and for certain work it was unnecessary to wear glasses, even if normal vision were obtained by them.

With regard to this and the amount of vision necessary for various kinds of work he felt that ophthalmic surgeons had had too little to say.

He pointed out the impossibility of a soldier using his gas mask with spectacles on, for the latter became at once clouded with moisture from perspiration.

Mr. Bernard Cridland said: During the past four years, naturally and rightly, military ophthalmology has mainly occupied the attention of the ophthalmic world, but I feel that we should not be fulfilling our duty as ophthalmic surgeons to the nation as a whole if we did not exchange views as to the effects, if any, of the war upon the civil population. I wish, therefore, to bring before the Congress one or two points which relate to the civil population as arising out of the war.

(1) As regards *glaucoma*. How does this disease stand in relation to the war?

In a letter to the *Lancet* in September, 1915, a London surgeon made the statement that he had seen in the preceding three months four times as many new cases of glaucoma as in the corresponding quarter of any year, and that a large proportion of the patients had relations serving in the war. He asked whether others had noted the same occurrence. The experience of the surgeon is of course interesting only in view of the war;

but in this respect his question is one which should be answered by as many as are able, and for this reason, that whilst an increase in the case-incidence of glaucoma is just what might be expected to happen in this time of stress and anxiety, the question is, "Is it actually happening?"

My own experience, which has been obtained by an examination of hospital statistics before and during the war, and also by my private case books, is as follows: 1912 compared with 1916 showed a slightly higher percentage of glaucoma. 1911 also showed a slightly higher percentage than 1916. *Private case books*—distinctly fewer cases were seen in 1916 than in either 1911 or 1912. It is an open question whether the war has increased the case-incidence of glaucoma, although in any given case it may naturally be the exciting factor of the moment.

(2) *Exophoria*, or perhaps one should say "insufficiency of convergence."

With regard to this condition, my experience is that it has been found to be more patent amongst private patients during the war than before.

Hospital patients may have revealed this in a like manner, but I confess that I rarely examine patients for exophoria in the out-patient department—a place where the greatest good has to be done for the greatest number in the time at disposal.

Cases which before the war showed no convergence insufficiency have been found now to reveal it in a striking manner; and in my experience this was especially noticeable in the early part of this year, when the food difficulties were greatest. Presumably this is what is to be expected, and is indicative of a lack of tone in the nation generally.

(3) *Infrequency of litigation regarding accidents and Workmen's Compensation Act.*—A striking feature in another realm of our work has been the paucity, or almost complete absence, of litigation under the Workmen's Compensation Act.

As a medical referee for ophthalmic cases for my county court district, I may say that I have had only two references from the judge, and although summoned to sit as an assessor on two other occasions, both cases were settled out of court before the day set apart for the arbitration.

High wages and the demand for work are doubtless accountable very largely for this condition, and in a certain percentage of cases an honest desire in the individual himself to get back to work as soon as possible in order to help on the war as far as his share goes.

In hospital practice one sees very little nowadays of that desire to remain "on the box" as it is called.

It would be well for those who may be called upon to express opinions in court in peace time to bear this in mind, and to draw a more careful distinction in the future between actual disability to work and unwillingness to do so.

It certainly shows that litigation is far less a necessity than it appeared to be before the war, and that our county court judges have in the past taken a far too lenient view as to a man's capability for work after an injury—a view which, perhaps, we have ourselves shared too freely.

Lastly, I would like to draw attention to the very excellent work which has been done by the medical members of the "Health of Munition Workers Committee," and of other medical men who have worked for them.

Memorandum No. 21, by Dr. Vernon, entitled "An Investigation of the Factors concerned in the Causation of Industrial Accidents," is a really valuable treatise on the subject generally. As far as ophthalmic injuries are concerned, it is interesting to note that "accidents due to foreign bodies were 7 to 27 per cent. more numerous in the night shift than in the day shift, though all the other accidents were considerably less numerous. This was due to the artificial lighting, as the excess of eye accidents was most marked in the worst-lit factory."

The need for better lighting in factories and shops is a point which has been drawn attention to by ophthalmic surgeons many times already, but now that it has the opportunity for a wider recognition than before we may hope that more action in this respect will follow in the future.

Memorandum No. 15 is one which deals with "The Effect of Industrial Conditions upon Eyesight." It contains expressions of opinion regarding eye accidents in general which have been received from various ophthalmic hospital surgeons throughout the country. Some excellent conclusions, which cannot but meet with the cordial approval of all ophthalmic surgeons, have been drawn from these opinions. There is one paragraph which refers to eye-guards and goggles to which I wish to draw your attention. The paragraph begins:

"Under certain conditions the eyes should always be guarded from flying particles of metal. To be effective, an eye-guard—(*a*) should prevent particles from reaching the eyes from in front, from either side or from below. Practically nothing enters from above. (*b*) Should be light and comfortable and allow free play of air, so that moisture does not condense on the transparent medium. (*c*) Should not impede vision, or become obscured by the impact of particles. (*d*) Should be strong and cheap."

All very excellent. One has only to add to these that the guard should never wear out to make the ideal protector. But does such a thing exist? There are pictures of eye-guards given in this memorandum, but it is easy to see they fall far short of the above-stated requirements.

Now, until the ideal eye-guard is invented it is certain men will not be induced in anything like proper numbers to wear a protection, and I feel that it is, to use an expression, "up to us," as ophthalmic surgeons, to invent such a guard as will commend itself to the most ignorant and antagonistic workman.

The war has taught us what can be done in this respect

and no one who has seen Capt. Cruise's admirable protector in its latest form could be other than enthusiastic over what is really a clever and efficient invention. Why cannot this or some modification of it be applied to industrial work? Certainly the production of the ideal eye-guard is a point well worthy the consideration of all surgeons who practise in industrial districts.

These are a few of the more practical points which have occurred to me as arising out of the relationship of ophthalmology and the war as regards civil life.

Mr. R. J. Coulter said that he had had good results with whole skin-grafts from the arm in cases of destruction of the eyelids.

Major A. C. Purchas, N.Z.M.C., stated that in cases of trench nephritis at the Front he had been struck with the infrequency with which he had noted any retinal changes—only one case among the many which he had seen—but he explained this on the grounds that the changes did not occur early, or, at any rate, until after the case had been evacuated.

With reference to lacerated lids, he suggested that whilst waiting for healing to take place, massage, with rolling of the adhesions, was very advantageous, for it modified the amount of subsequent repair necessary.

Commenting on the cases of total blindness in the past two and a half years, he had been struck with the fact that he had only seen two such amongst the New Zealand patients, although he had had a great many with one blind eye.

One of these totally blind cases was interesting in that the damage to one eye, the other being totally lost, had been due to a piece of bone becoming embedded on the cornea; the piece of bone was a fragment of another man, who, standing close by, had been killed by the same shell which injured the patient.

Staff-Surgeon R. J. E. Hanson said he was interested in the remarks regarding naval cadets.

In the course of his duties he saw every cadet who had

any refraction error or defect, and he always advised the parents to take such a boy out of the Navy.

The result of a boy remaining in the Navy with a defect was that no matter how good he was in other respects he became what is known as a "salt horse," *i. e.* unfit for duties requiring perfect visual acuity.

Capt. T. H. Whittington said that since his return to England he had been struck with the difference in the proportion of soldiers wearing spectacles in England and in France.

In his experience as a regimental medical officer, he did not remember having seen a man wear glasses in the trenches, the main reason being the handicap in wearing them with a gas-mask, for it was then impossible to keep them clear of moisture from perspiration.

Another disadvantage in the wearing of spectacles under active service conditions was that when broken, as with other appliances, they formed an excuse for reporting sick.

He had found that sighting a rifle was a useful adjunct to the ordinary visual tests.

Mr. J. Gray Clegg, commenting on the almost complete absence of sympathetic ophthalmia in military injuries, suggested that the healthy life of the soldier made him less liable to the disease, and also that probably surgeons were more prompt in removing the injured eye than in civil life.

Dr. George Young, referring to the possibility of naval candidates developing myopia, said that in his experience quite a number of cases of this kind had reduced light sense, and that myopia may develop in the absence of any family history which might be an indication as to its subsequent appearance.

An important sign in emmetropic children was the presence of slight recurvation of the vessels on the temporal side, and in such cases he advised re-examination in two years.

3. *Some aspects of military ophthalmology.*

By S. Hanford McKee, C.A.M.C.

It would be quite impossible in a paper of this kind to go over many important parts of this branch of military medicine, let alone the whole field. I have taken the title advisedly, knowing full well there are many sides of this subject which I shall not be able to bring to your notice. In fact I have had to be content with presenting to you certain views of military ophthalmology which seemed to me of more than ordinary medical interest.

Military differs widely from civilian ophthalmology and varies in a wide degree, as one is at work in training camp, at the base, or in one of the various parts of the various fields. It was my privilege to undertake military duty on the day following declaration of war, and apart from three months' illness I have been constantly engaged in that duty. These notes are the result of observations during that period, first in Canada, later in France, then on the island of Lemnos and latterly at a base hospital devoted entirely to the diseases of the eye, ear, nose and throat.

One of my first impressions at camp was how essential it was to have in a military hospital unit someone with a special knowledge of ophthalmology. One's first duty, the examination and classification of recruits, very definitely demonstrated this. "The standard of vision" has passed through many vicissitudes. When the war began it was as follows:

(*a*) If a recruit can read $\frac{6}{24}$ or better with each eye without glasses he will be considered fit.

(*b*) If he can read $\frac{6}{24}$ at the same distance without glasses with the right eye, and not less than $\frac{6}{60}$ with the other eye without glasses, he will be considered fit.

(*c*) If he can read $\frac{6}{24}$ at the above distance with the

left and not less than $\frac{6}{60}$ with the right eye without glasses he will be considered fit for the A.S.C., A.M.C., A.O.C., and for drivers for the R.A. and R.E.

The standard which specified $\frac{6}{24}$ in each eye was not a high one, and was a low standard compared to other continental armies. The result was that many men of this vision had their training practically completed except musketry. This they were not able to pass at any distance beyond two hundred yards.

This standard of vision was later modified to—

(*a*) If a man's vision is $\frac{6}{24}$ in one eye without glasses and his right eye can be brought up to $\frac{6}{12}$ with glasses he shall be considered fit for category "A."

Though the general principles regarding standard of vision may be fixed, there are many reasons why a definite standard of vision required must be altered from time to time. Comparison of methods during the South African and the present war will suffice to illustrate this. In a report of the Committee appointed by the Council of the Ophthalmological Society the following is found:

"The general principles which should be taken into consideration in fixing a standard of vision for enlistment into the army are as follows:

"(1) That a man's united sight should be sufficient to enable him to find his way about in bright and dim lights, and be such as will prevent him from being a danger to his fellows.

"(2) That he should not suffer from any progressive disease of the eye, or one likely to recur.

"These two general principles apply to all branches of the service, combatant and non-combatant."

This is indeed a generous basis to work from. Personally, I feel a standard of vision without glasses should be insisted upon, for I believe that a recruit with $\frac{6}{24}$ vision in the right eye is a more useful soldier than a recruit with $\frac{6}{12}$ vision with glasses in the right eye. My experience after four years is, that the man with $\frac{6}{24}$ vision without glasses is much to be preferred.

The examination which consists only of sight-testing must prove unsatisfactory. The soldier should always have a good field of vision in each eye, and his eyes should be practically free from disease. We demand that the right eye must be the good one. The general objection given for not allowing shooting from the left shoulder is the difficulty in teaching the recruit to get off the necessary "rounds" per minute, and that in the trenches men firing from the left shoulder are more or less of a nuisance to the right-shoulder shots. Whilst conditions are bound to change, standards of vision that have been latterly adopted seem to me fairly satisfactory. I would certainly recommend no further lowering of the standard. For it is to be remembered that one has to consider not only vision by day, but bear in mind the importance of vision by night. Sentry duty at night is, of course, one of the most important duties of the soldier. There are in the service men with less than the standard vision, men who are not even fit for home guard duty, passed from one service to another and from one hospital to another in an extremely vicious circle; no one evidently with the courage, or whatever is required, to say that "This man is useless in the Army; get him back to civilian duty." It is so simple to pass a recruit not up to the standard, but it is exceedingly difficult to get the Army rid of this man, be he as useless as possible. Lowering the standard and enlisting men who fall below the prescribed standard does no good in the way of helping national defence. On the other hand it does a great deal of harm, as a useless individual in the Army is much more of a nuisance and does more harm than a useless individual in civilian life. The question of standard of vision is by no means a simple one, for no matter what actual standard is demanded, there will always be found men with that standard who are unfit, and men below the standard who are fit. So much depends upon the individual, whether he is "keen" or not. I consider a soldier who is anxious to do his

duty and has only $\frac{6}{24}$ vision in each eye infinitely more useful and a better soldier in every respect than the disgruntled one with $\frac{6}{6}$ in each eye. There is also a certain proportion with mental amblyopia, among whom the amount of vision is not much of an indication of their usefulness. The military point of view should teach a medical officer "to size up" his patient, and considerable latitude should be allowed to the military ophthalmologist as to who "sees to shoot" and who "sees enough for ordinary purposes."

There has been a demand for not one, but for many standards of vision, as a standard of vision compatible with efficiency in one branch of the service would be absurd if applied to another. This, perhaps, is true; the drawback to it, however, is what actually happens, and that is, that a man with vision compatible with efficient service in one branch is transferred to another where his vision makes him inefficient and perhaps a nuisance. Men are constantly changed from one service to another, and in cases of great emergency, such as have occurred in the not distant past, even non-combatant units have been called upon constantly to take up combatant duty. It has been suggested that it is easy to adopt a high standard of vision, and to reject without further inquiry all recruits who fail to reach it. It is, as a matter of fact, not so easy as it may seem; I only wish it were, for if the standard of vision had been adhered to I feel sure millions would have been saved to this country. Lowering the standard of vision will increase the number of passed recruits marked "fit for service," but it will not increase the number of bayonets, and it will very materially lower the efficiency of the Army. Anyone who believes it is easy to adopt a standard and reject all recruits who fail to reach it, please note the following few cases, taken here and there from hundreds:

Pte. P. H—: R.V. $\frac{6}{36}$, not improved; L.V. $\frac{6}{60}$, not improved; diminution of vision due to amblyopia from

a high degree of astigmatism. *Pte. W. C. W—*: R.V. $\frac{6}{60}$; L.V. 4–8 ft. *Pte. R. R. H—*: R.V. fingers at 2 ft.; L.V. $\frac{6}{60}$; astigmatism and amblyopia. *Sergt. F—*: R.V. $\frac{6}{60}$; L.V. $\frac{6}{36}$; 5 D. astigmatism right eye and $\frac{4}{5}$ in the left. *Pte. A. B—*: R.V. $\frac{3}{60}$; L.V. $\frac{3}{60}$. *Pte. G. B—*: R.V. no perception of light; L.V $\frac{6}{36}$. *Pte. A. W—*: R.V. perception of light; L.V. perception of light; myopia, 25–30 D. *Pte. H—*: R.V. $\frac{6}{36}$; L.V. $\frac{6}{24}$; amblyopia from astigmatism; this man has been under military pay for eight months. *Pte. B—*: R.V. $\frac{6}{36}$; L.V. $\frac{6}{36}$; convergent strabismus; nystagmus. *Pte. T—*: R.V. $\frac{6}{36}$; L.V. $\frac{6}{36}$; this man was removed from the ranges as dangerous; one can well imagine what he would be under more trying circumstances. *Pte. J. H—*: R.V. $\frac{6}{36}$; L.V. $\frac{6}{36}$; 5 D. of astigmatism in the right eye and 6 in the left. *Pte. J. H. O—*: R.V. fingers at 2 ft.; L.V. $\frac{6}{36}$. *Pte. F. H—*: R.V. $\frac{6}{60}$; L.V. $\frac{6}{60}$; retinitis pigmentosa. *Pte. A. F—*: R.V. $\frac{6}{36}$; L.V. $\frac{6}{36}$; old trachoma with pannus. *Pte. L. J. K—*: R.V. $\frac{6}{60}$; L.V. $\frac{6}{60}$. *Pte. H—*: R.V. $\frac{3}{60}$; L.V. $\frac{3}{60}$. *Pte. B. R—*: R.V. 6–8 ft.; L.V. $\frac{6}{60}$.

These details may surprise some of you as to some of the individuals who have been passed fit for military service. These men are absolutely incapable of any military work, but rest assured that they will all be fully capable of attributing their disability to service, and demanding a pension when that time comes. From the low standpoint of cost this is a large question. Take, for instance, the following cases:

Pte. F. J. B—, æt. 26 years, $2\frac{8}{12}$ years' service. Ten months ago, whilst in France, this man began to be troubled with headaches and with difficulty in seeing at night, and for this he was evacuated to England. Upon admission to hospital R.V. is $\frac{6}{36}$; L.V., counts fingers at 1 ft. Examination of the fundus shows marked disseminated choroiditis in each eye, more marked in the left. There is no history of illness previous to enlistment except malaria five years ago. He says the left eyesight

was "poor" on enlistment. Wassermann negative. How much of this man's present disability is due to service, and how much of his disability is pensionable?

Spr. N—, after some months' service in France, was admitted to hospital April 11th, 1918. R.V. $\frac{6}{24}$; L.V. fingers at 3 ft. In the right eye there are several patches of choroidal atrophy, in the left eye extensive vitreous opacities. He claims his vision was good on enlistment; the fundi, however, show a condition which looks like an old one. Wassermann negative, urinalysis negative. This man is unfit for service and must be discharged. How much of his disability is due to service, and what pension is he entitled to?

The medical officer who lowers the standard and passes an unfit recruit does his country harm from more than one point of view. The military medical officers should have the assistance of an ophthalmologist, or someone competent to say what eyes are diseased and what eye conditions are incompatible with efficient service. Medical officers should be competent not only to estimate the amount of vision, but they should be instructed in the essential details in this respect, and be competent to give an opinion as regards an eye, whether healthy or pathological. The Canadian Medical Service has been far in the vanguard in this respect. The appointment of an officer specially qualified in ophthalmology to a position in a field ambulance to attend to special work in certain areas marks a big step forward in military medicine. Unfortunately there are still many specially trained medical officers who are enshrouded in that wondrous work, "Administration."

In military as in civilian ophthalmology, a considerable percentage of one's work consists in the estimation of the errors of refraction and work relative thereto, and in this part of one's duty it is most essential to get the military point of view. And by this I do not mean to regard almost every patient who appears as a malingerer, but for one to understand that in military life one is dealing with

individuals, a certain percentage of whom are not averse to avoiding duty, be that even a pleasant one. In civilian life one is consulted in the hope that a proper remedy may be supplied, and, consequently, has the whole-hearted assistance of the patient; in military life the soldiers are often individuals who wish to avoid work and duty—who, to give it the soldiers' term, are "swinging the lead." One needs to be very much on the alert in examining such cases, as a great deal depends on the personality of the medical officer. To be hasty with men of this class is to defeat one's self. The best method of dealing with them is to deceive them as to your knowledge of their case as they are deceiving you, or think that they are, as regards their complaints. When one finds a low visual acuity without any evident cause, suspicion is, of course, aroused; but whether it is the patient's manner or what, almost invariably there is something which tells one this patient is not telling the truth. Unless a soldier's vision is improved considerably by glasses, he will not wear them, so that there is only one reason which warrants prescribing glasses for a soldier, and that is, by prescribing glasses you change him from an unfit to a fit soldier. To my mind there is no other excuse which warrants putting glasses on a soldier, for it is to be remembered that if a soldier can get along without glasses he will, especially since gas-masks have come in vogue, and it is a grave mistake to prescribe them, for when you do you supply him with an excuse which he always has with him for lining up on the sick parade. A man who breaks his glasses or a man wearing glasses who complains of headaches is immediately sent away for examination, and immediately avoids a duty which he did not wish to perform. It does not matter whether his refraction was finished only a few days previously or not. Medical officers have learned well to associate headaches with errors of refraction. It is to be remembered that, in a soldier, complaints of headaches or pains of any sort are not reliable symptoms of disease. I opened two mastoid

processes in France before I found out that pain was not a reliable symptom of disease—certainly not in a soldier wishing to get to "Blighty." Again, in the healthy, out-of-door life of a soldier errors of refraction should not cause headaches. Pains in the head of all kinds, photophobia, and night-blindness are frequently complained of; the actual visual defect seems to be the last complaint thought of. Amongst soldiers one finds a tendency to exaggerate a natural defect, so that the estimation of the real error is by no means simple. The patient may have worn glasses for astigmatism or for a small degree of myopia before enlistment and then discarded them. It is difficult to get such patients to admit improvement in their vision even with proper lenses, and, as suggested, the detection of this obstinacy is sometimes exceptionally difficult. I consider the wholesale refraction of troops and the supply of glasses to combatant forces a grave mistake. Where glasses are ordered I feel they should be as simple as possible. It is a grave mistake to give a soldier with normal vision lenses correcting small degrees of astigmatism and hyperopia.

Pte. C. Q— has R.V. $\frac{6}{18}$, L.V. $\frac{6}{12}$, each eye with cyl. and sph. + 1 corrected to $\frac{6}{9}$ plus. With both eyes this man had $\frac{6}{6}$ vision, but returned within a month to say that he could not "see with his glasses"

Pte. M— came complaining of headaches and dizziness. Dizziness has now become a fairly common complaint, as it has been found out that this is a symptom which promises well as regards the object desired. There was no error of refraction, fundi were normal; with a + and − 2 before each eye his vision was normal.

Pte. H—. R.V. $\frac{6}{5}$, L.V. $\frac{6}{18}$. He had been prescribed a + 1 right eye and + 3 for the left. This man had served a long while in France without glasses. There is hardly an indication to supply glasses here in civilian, let alone military practice.

Pte. G. W. A— came with marked photophobia; he had $\frac{6}{60}$ vision in each eye, which can be improved to $\frac{6}{36}$

and $\frac{6}{18}$. As is usually the case, this man says he is unable to wear the lenses, as they hurt his eyes and do not help the constant "blinking."

During the examination for refraction one finds a variety of defects, prominent among them amblyopia *ex* anopsia. If these cases have slipped through the examiners and have been overseas the blindness is almost always attributed to overseas service. Where there is a large degree of astigmatism the probability is that the amblyopia is of long standing. Squint, scars on the cornea, myopia and astigmatism help to place the amblyopia as old, but latterly, after having observed the pranks of high explosives on the shape of the eyeball, I am very careful in coming to a hasty conclusion. From observation I feel sure that I have seen cases of men who have had normal vision before proceeding to France, and who, from the effects of high explosives, are now men with a high degree of myopia. Cases have also been seen of very high amounts of astigmatism—5 or 6 dioptres in each eye. These patients in civilian life were at such work as engine-drivers, where routine examination of their vision was made. They say it would have been impossible for them to have carried on their civilian work with such visual defects. There is no way I know of to explain this defect, except from high explosive.

P. D— was blown up by a shell in August, 1916; right and left contusion of the eyeball. On admission, R.V. was $\frac{6}{36}$, L.V. $\frac{6}{12}$; the right disc was badly cupped; this has gradually disappeared. There remains R.V. $\frac{6}{36}$, with a high degree of myopia and astigmatism, with normal fundus. L.V. normal. This man is positive his right eye has been affected only since his being blown up.

The following is a typical case: Pte. McC—. This man says his sight was good before going to France. There is certainly no doubt that it must have been very much better for him to have got to France. On April 1st, 1917, he was operated on for G.S.W. head, with fracture

of outer table. R.V. $\frac{3}{60}$, L.V. $\frac{6}{60}$. With — 7 each eye vision $\frac{6}{24}$. No fundus changes.

One day I was called to the throat clinic to see an ear case—a patient who had been deaf and dumb for several months. He had not been overseas. After getting the history of the case I examined him in the usual way. When I had finished I said to the medical officer, whilst looking right at the patient: "This man hears as well as you do; report him a malingerer." The man went back to his battalion and reported that he had been "faking" all of this time. The malingerer who comes to the hospital with the intention of deceiving you is a nuisance indeed. It is surprising the amount of your time he can waste. "A malingerer is one who is not ill and pretends that he is; if he *bonâ fide* thinks he is ill he is not guilty of that pretence." When your suspicion is aroused, most of these cases are detected by Snellen's letters. Some of this type, however, are almost uncanny in their ingenuity, and their mental outlook needs to be studied very closely. Some maintain malingerers can only be successfully dealt with by strong measures, such as the faradic current. The malingerer may stand one or two applications, but he cannot face the prospect of a daily repetition and so he quickly gets well. With functional cases one needs to be very patient; they resent, perhaps properly so, being told they are malingerers, and resent it keenly. I remember in the early days of the war examining a patient who had to be led into the clinic, but who, with a + and — 6, could read $\frac{6}{6}$. I made a note on his chart that he was a malingerer. Some enthusiastic chum of his read it to him. He felt very keenly on the point. He had volunteered originally; he had been overseas, wounded, returned to Canada, had given up a good position a second time, and re-enlisted and been to France again. Nevertheless, there were the facts; he could read $\frac{6}{6}$ with a + and — 6, although he had to be led into the clinic. It was with the greatest difficulty that I restored his peace of mind.

The patient with functional amblyopia, war neuroses, or

whatever name you wish to give it, is entirely different. Some of these are pathetic in the extreme. In dealing with cases of this class the first thing obviously to do is to decide whether you are dealing with disease, a functional condition, or malingering, and here it might be well to remark that it is a mistake to think that all malingering is the outcome of deliberate wickedness. Moral responsibility is a variable quantity, and great allowance has to be made for the personal equation. The patient with functional amblyopia is much easier to diagnose than the malingerer. A method with which I have had great success is as follows: One eye is examined at a time and the vision recorded; this may be anything from hand-movements to $\frac{6}{24}$, seldom above it. A + 6 is then placed before the eye, and the patient is asked whether that blurs his vision or not; the answer is generally that the vision is more blurred; a − 1 is now added, then − 2, and 3, and 4, and 5 and 6 slowly, and at the same time encouraging the patient whose vision has been improving with the application of each lens, so that at the time that we have a + and -- 6 before the eye he reads $\frac{6}{6}$. This method has proved most satisfactory where the blindness complained of has been of one or of both eyes, and also where the dimness of vision has been only one of degree.

When the diagnosis is established treatment must vary accordingly; and here much depends upon the individual you are dealing with and how you have sized him up, and perhaps what impression you have made upon him. Rest in bed, with a sedative, for a few days, nearly always improves these cases. Sometimes widely dilating the pupils is a beneficial measure. Easton's syrup, baths, light exercise, generally suffice to bring about a cure. On the other hand, one meets from time to time with cases that are exceedingly refractory.

Spr. G. W. R—, æt. 25 years, with $3\frac{5}{12}$ years' service, was gassed in December, 1917, when his face was slightly burned. He was evacuated from France, and was admitted to West Cliff Hospital February 18th, with a

history of having been blind since the day after he was gassed. The pupils and the fundi were normal; vision of each eye acknowledged was not more than perception of light. With a + 6 and a — 6 the patient would only admit $\frac{6}{60}$ vision. He was put on Easton's syrup, drops of sulphate of zinc 1 per cent. (they generally derive more benefit from drops that sting slightly). Two weeks later the vision had improved with the above lenses to $\frac{6}{36}$ in each eye. We had at West Cliff at this time a number of blinded patients who were about to proceed to St. Dunstan's Hospital. The patient in question heard so much about St. Dunstan's, he evidently made up his mind he was going there. He had to be led about, he started to study Braille, and he was most persistent that he be sent to St. Dunstan's that he might learn a trade. To remove him from a "blind" atmosphere, I had him transferred to another Canadian hospital, where cases of war neuroses are treated. Being interested in this case, I wrote to the O.C. a short time afterwards, and the following is part of his reply: "The day following his admission he was given three minutes' treatment with the faradic wire brush, and at the end of that time admitted he could see quite well. Since that time there had been no tendency to blindness, and he will shortly be discharged to duty."

Lieut. M—, æt. 22 years, with six months' service in France, was wounded May 10th at F——. Slight wound in the arm. He was also buried for some minutes at this time. He was invalided from France and had been in a number of hospitals, and although he noticed in France that his sight was failing, it was only while in hospital in England that he suddenly found that he was completely blind. He was admitted to West Cliff Hospital October 13th, 1917. Vision of about $\frac{2}{60}$ in each eye; not improved; no fundus or organic disease. He was put upon Easton's syrup, rest in bed, etc., being taken out daily for a walk, and was being led about by a friend. Three days later the vision was fingers at

2 ft. in each eye, with + and − 6, $\frac{6}{24}$; two weeks later his vision had improved to $\frac{6}{18}$ plus; two weeks later his vision with these lenses was normal in each eye. When it was explained to him that the glass that he had in front of his eye was very weak, he was convinced that his vision was good without glasses.

Whilst tests for vision and refraction form a large part of military ophthalmology, one finds in camps the ordinary civilian complaints, the usual number of accidental injuries, ruptured globes—the usual material of a good clinic. One feature of cases seen in camp was the large number of phlyctennlar conjunctivitis cases in adults and the large size of the phlyctenules. I have never seen anything approaching them in size. I have not seen an epidemic of conjunctivitis amongst soldiers, and very few cases of gonorrhœal ophthalmia. Trachoma (or *Ophthalmia militaris* of the last century) has almost disappeared as a military disease. The importation of labour into our army from the East may, however, alter this. The absence of an epidemic of conjunctivitis and the absence of trachoma is of interest, considering the condition of Europe during the Napoleonic Wars. Historically, it may be of interest to recall to your mind the fact that Hannibal's Army was incapacitated for one winter in Italy with ophthalmia. Following the original gas attack in France in April, 1915, there were a large number of cases of conjunctivitis. I was struck with the sequela of iritis in a number of these cases, and in discussing this matter with Prof. Morax, he had also noted this condition. Evacuation was being carried out so rapidly, however, it was impossible to follow up this point. The mustard gas conjunctivitis of the present day is a condition marked by intense and persistent photophobia, with marked blepharospasm and severe lacrymation. It is most persistent in its course, and not infrequently leaves behind it macula corneæ and a persistent blepharitis or eczema of the lids. In early cases an oily lubricant is beneficial and grateful, with

drops of cocaine and adrenalin, this to be followed later on by some astringent drops such as sulphate of zinc. I dislike supplying dark glasses to these cases, as in many of them the functional element is very apparent, and it is quite difficult to get the patient to do away with the dark glasses after he has been wearing them for a little while. Conjunctivitis has been seen associated with dysentery enough to excite notice. Whilst in the East, recovering from dysentery, I myself developed a severe conjunctivitis. This was prodromal to an acute rheumatic condition. The appearance of a severe metastatic conjunctivitis preceding an acute rheumatism has been noted.

Amongst military symptoms of disease night-blindness takes a prominent part. It has been frequently met with, and in a number of cases has been associated with true retinitis pigmentosa. Nyctalopia in soldiers has been put down by some as a symptom of neurasthenia. This I think a mistake, from the cases that have come under my observation.

Functional night-blindness was well recognised before the war, and nyctalopia has been reported as endemic in certain countries, especially in Russia during the Lenten fasts. It seems to me, we may well attribute this complaint or disease in a certain number of cases to exposure, with the hard work and great fatigue consequent on service. There is, however, no doubt in my mind that many soldiers have heard a chum complain of night-blindness with the desired result, and have then gone and done likewise. A clever malingerer finds it an easy complaint to assimulate, and one the simulation of which is hard to detect.

The result of Wassermann reactions amongst individuals of military age may be of some interest. In 105 cases of iritis the reaction was positive in 33 and negative in 72. These are remarkable figures when one considers the age of the majority of patients, and the relationship between venereal disease and active service. In 4 cases of retinitis pigmentosa the reaction was negative; in 11 cases of

optic neuritis 5 were positive, 6 negative; in 7 cases of interstitial keratitis the reaction was positive in all; in 30 cases of retino-choroiditis 15 were positive and 15 negative. In the *Canadian Medical Association Journal* for November, 1916, Capt. H. G. Courtenay and the writer reported on a number of cases where eye lesions, such as iritis, optic neuritis and retino-choroiditis had appeared in soldiers who had had a full course of arsenical and mercurial treatment.

Lieut. W. L—, æt. 22 years, consulted me in May, 1917, on account of the loss of vision of his left eye. He had been infected in December, 1916, for which he had had a complete course of treatment of both arsenic and mercury at one of the military hospitals. Upon examination, the right eye was found to be normal, the left vision fingers at 3 ft., due to dense opacities in the vitreous, which prevented a detailed examination of the retina. Upon inunctions of mercury, hot baths, and hypodermic injections of pilocarpine his progress was steady and satisfactory. At the end of one month the vitreous had cleared, so that the retina could be seen, and the dimness of vision was found to be due to hæmorrhages in the macular area. His vision was then $\frac{6}{36}$.

Bdr. J. D— came to the clinic in June, 1917, with a gumma of the right iris—this after a full course of arsenic and mercury.

Sergt. G. C. F— reported to the clinic with a retino-choroiditis syphilitica. He had recently finished treatment extending over 167 days.

Pte. S—, æt. 30 years, service $2\frac{7}{12}$ years, reported at the clinic on March 24th with right and left vision fingers at 1 ft. Examination showed very severe retino-choroiditis in each eye. This man had only finished a course of arsenical and mercurial treatment in January, and in February had a negative Wassermann. Under inunctions of mercury his progress has been steady. At the present time his vision in each eye is $\frac{6}{18}$.

The treatment of syphilis of the eye will always, I

presume, be a subject of, more or less, controversy. Each one, however, must profit by experience ; I prefer to treat such cases to a conclusion for their eye condition, and then hand them over to a venereal expert for further examination and treatment if necessary. To my mind, syphilis of the eye reacts better to treatment by inunctions of mercury than by any other.

Among roughly 3000 ophthalmic cases admitted to West Cliff Eye and Ear Hospital I have seen two cases of sympathetic ophthalmia.

Pte. G— was wounded June 4th, 1917, at V—— in the right eye and right shoulder. The right eye was removed on June 26th. On July 28th he first noticed his left eyesight failing, and on July 31st he was admitted to West Cliff Hospital, service of Capt. Newbold Jones, with a well-marked sympathetic ophthalmia. The iris was injected, and adherent to the lens capsule at four points, punctate keratitis, dust-like opacities of the vitreous, and optic neuritis. The eye was bandaged, and he was put on systematic treatment of salvarsan and mercury and local treatment with atropine. The eye quieted gradually, the iris assumed a normal appearance and position, and on December 18th his vision was normal, eye quiet.

Col. V. K—, æt. 61 years, was injured in the left eye on September 27th, 1916, and admitted to hospital that day. In spite of constant ice compresses, the eye on the morning of October 18th was slightly painful to pressure, and was enucleated the same morning. He was discharged from hospital on October 30th, the right eye normal with vision $\frac{6}{5}$, the whole line. During the following week he developed a sympathetic ophthalmia, and was treated outside by excision of the stump of the optic nerve and salvarsan. Some weeks later he was seen at this hospital ; he had completely recovered and had normal vision.

During routine examination many interesting congenital conditions of the fundus have been seen. The concussion following modern explosives leads to a great variety of fundus lesions. This subject has been taken up by a

great number of writers in this country as well as abroad. The injuries are caused by the violence communicated through the bones of the skull, the bones of the orbit, or by air vibration—windage. The most remarkable part of this study to me was to see the serious damage which could be done to the eye due entirely to windage, and these where there was apparently no injury caused to the sclerotic coat. Lagrange has recently published a war atlas dividing the fundus lesions into groups, and defining rules governing disorders of this kind. He says lesions by concussion are seated at the posterior below, and especially in the macular area ; and secondly, that the lesions by contact are always in front of the orbital fracture, or at the very spot where the missile could graze the eye ; that the lesions by concussion are choroidal, and those by contact chorio-retinal. He describes a condition which he calls traumatic proliferating choroido-retinitis, which is the result of organisation of the blood extravasated up to the superficial layers of the vitreous through the lacerated retina. We have seen a great variety of these different fundus lesions.

Pte. E. C. L—, wounded at P——, October, 1917. Externally the right and left eyes uninjured. The left eye below shows a large rupture of the choroid with retino-choroiditis proliferans ; the right eye shows a small rupture of choroid to the temporal side and below—the choroido-retinal changes from contact.

Pte. W. D. S—, wounded below the margin of the right orbit, fracture of the malar. Left vision $\frac{6}{9}$, right vision perception of light. The right fundus shows below the border of the disc a large rupture of the choroid with numerous areas of displaced pigment—another choroido-retinal condition from contact.

Also Pte. W. H. F—, wounded in the head, fracture of the frontal bone. No external injury to the eye. Fundus shows small rupture of the choroid below macular area, displacement of pigment above and to the outer side, and a pepper-like appearance in the macula.

Sergt. R—. In March, 1917, this N.C.O's. gun was hit and there was tremendous "windage" to the right side of his head. He was evacuated for wound in the foot. He soon began to notice spots before the right eye. Externally this is normal. Toward the periphery of the nasal side of the disc there is an area about one and a half times of the disc of displaced choroidal pigment, also dust-like opacities in the vitreous. R.V. $\frac{6}{36}$, L.V. normal. Choroiditis from concussion.

Coy.-Sergt.-major B—. This N.C.O. had, on March 9th, 1918, a fall from a bicycle, injuring his head. Notes on the case state that he fractured the temporal bone at the external angle of the orbit. On recovering consciousness he had only perception of light in the left eye. This has not improved since. R.V. $\frac{6}{6}$, L.V. perception of light. The left fundus shows primary atrophy of the optic nerve.

One of the commonest lesions of the fundus which I have met with and which I have not seen described anywhere is a condition of traumatic retino-choroiditis, characterised by diffuse cloudiness of the retina, numerous small exudates in the choroid, and fine, dust-like opacities of the vitreous. It is identical with retino-choroiditis of secondary syphilis. It varies in degree from a very slight opacity of the vitreous to diffuse, thick opacities with changes in the choroid. I have seen a large number of such cases where, I am positive, the changes were due to trauma-windage.

Pte. V— was buried on the S—— a very short time. R.V. $\frac{6}{6}$, L.V. hand-movements; left vitreous full of dust-like opacities, retina cloudy. Wassermann negative. A typical case of traumatic retino-choroiditis, which has been by far the commonest form of traumatic lesion of the fundus that I have seen.

Pte. F—, æt. 34 years, was blown up on March 2nd, 1918, since which time the sight of his left eye has failed perceptibly. Prior to this accident his vision was good, but since the explosion it has been failing, so that at the present time he has L.V. fingers at 2 ft., R.V. $\frac{6}{6}$. In the

region of the macula he has a tiny patch of choroiditis; dust-like opacities. Wassermann negative.

Gnr. J. K— is an example of a typical case of traumatic retino-choroiditis. He was blown up at W——; luckily he was not injured in any way except he could not see so well with his left eye. Upon admission shortly afterwards to West Cliff, R.V. was normal, L.V. $\frac{6}{36}$. The optic nerve is obscured by dust-like opacities in the vitreous; there are some tiny opacities also in the lens. Wassermann negative.

Cpl. M— was admitted to hospital complaining of diminution of the right eye; this had followed an injury received in France when he was blown up. R.V. $\frac{6}{24}$, L.V. $\frac{6}{9}$; dust-like opacities in the vitreous, with definite choroiditis to the nasal side of the disc. Wassermann on two occasions negative.

Pte. R—, æt. 45 years, was hit by a piece of falling timber on the head and right shoulder in March, 1918, and a few days later he noticed the right eye was practically blind. When admitted to West Cliff, R.V. $\frac{3}{60}$, L.V. normal; right eye retino-choroiditis traumatica, left eye normal.

Surgery forms one of the most interesting parts of military ophthalmology, though many of the operations of civilian practice are not met with at all. One reason, and one reason alone, should form the basis for all military operative work—necessity.

It is most unwise to correct strabismus, for instance, for cosmetic reasons, or to do any operations of a similar nature. If a recruit is accepted for service with a disability of this kind, and an attempt is made to correct it, he first becomes a hospital patient without being ill or wounded (in itself most undesirable), and, secondly, he is given the starting-point for an attempt to obtain a pension.

Dacryocystitis is not infrequently met with in military work, and for military purposes—and the same would hold among industrial workers in civilian life—I can very strongly recommend the West operation. By this, after

elevation of the mucous membrane and chiselling away the bone over the lacrymal sac, the nasal wall of the lacrymal sac is cut away. An artificial communication with the nasal cavity below the inferior turbinate is thus established. Faulty drainage is corrected immediately, and the result most satisfactory. With Capt. C. W. Graham, C.A.M.C., the writer has done a number of these operations, and the result has been most satisfactory, especially so for military *personnel*, where syringeing, probing, etc., are inadvisable, and where the epiphora after excision of the sac gives the individual a constant disability.

Lieut. L—, æt. 43 years, came to hospital complaining that he had had a dacryocystitis right and left for some months. He was treated by syringeing for three weeks, and, although improved by this, the epiphora remained enough to be troublesome. Within a few days of each other a right and left intranasal drainage operation was done, with most satisfactory results. He was discharged to duty thirteen days later. He came to see me some months after whilst on leave. He had not had any further discomfort with his lacrymal apparatus.

This typical case is cited to show how quickly this method will enable one to return a man to his work, which, after all, is a medical officer's first duty. In one case we had some difficulty with post-operative adhesions, and subsequently used a celluloid splint for a day or two —a splint such as is used in submucous resection.

While eye injuries in the Chino-Japanese War of 1894 form only 1·2 percentage of all wounds, it will be found that they take a much larger percentage in this war. The terrible face injuries of Armageddon have placed before us the opportunity for wonderful development in plastic surgery of the face. For the repair of damage to the orbital walls Lagrange gives three methods: (1) Metallic plates; (2) adipose grafts; (3) Cartilage grafts. He quotes Morestin extensively in giving the history of cartilage grafts, and emphasises that he has

erred in trying to do too much at one operation. He first does a blepharo-plasty, and six weeks later introduces under the skin the necessary cartilage and cellulo-adipose tissue. Another more useful purpose to which cartilage is being put is its implantation after enucleation or evisceration of the eye. The restoration of the eyelids by frontal or malar flaps has proved most satisfactory. Enlargement of the conjunctival *cul-de-sac* has always been a difficult matter, and one not always approached with pleasure. "Magitot covers a piece of metal with an epidermis flap, and introduces this into the orbital cavity in such a manner that the lower surface of the flap is applied to refresh the surface of the inner aspect of the eyelids." Lagrange uses Snellen's sutures, and reports great success from this method. In the *Annals of Surgery* for March, 1917, Esser has given us his "Studies in Plastic Surgery of the Face." The procedure for enlargement of the conjunctival sac is described there as follows :

"The enlargement of the conjunctival sac is very often required to make room for the eye prosthese. In these cases the eyelid skin is then cut parallel with the eye slit, higher or lower according to the case ; generally scars must be taken away. And now, after lifting the upper part of the cut, an impression can be taken (best with the assistance of a dentist) with sterilised wax material. This, after hardening, is carefully surrounded in the described manner with very thin Thiersch, which is then placed in the wound and closed with pressure.

"The mould must be made in a manner and with such pressure that its size is such that afterwards, on sewing the wound together, sufficient tension results. Before cutting the Thiersch, which only takes place when everything is prepared to receive it immediately, without first placing it in a physiological solution, the hollowed mould must be placed in the hollow and the incision pressed together with the fingers to see if the tension is correct, otherwise the mould can be altered. It is not practical

to enlarge it by adding to it, as the join leaves a line where the Thiersch later on falls in, but it is better to make a new mould if the first prove too small. It is possible to decrease the size if too large by cutting before it is quite hard and softening down the cuts.

"The closing under pressure by the sewing is necessary for two reasons—first, the Thiersch is pressed everywhere for quick healing, and second, possible bleeding is prevented. Though I construct the hollows by cutting on purpose to open the most possible number of little blood- and lymph-vessels (by all free transplantations, I prefer this method to the blunt preparation in general use, because it gives better healing condition). By sewing together under pressure the small vessels are all closed—only the large arteries must be squeezed or twisted, but not tied, as no foreign substance may remain between inlay and wound. In consequence of the pressure a primary healing of the suture is not sure, but mostly of less importance, as an ugly scar can be easily corrected afterwards. After about two weeks the conjunctival sac is cut parallel to the eye split, and at such a distance from it where the inlay is nearest to the surface. The mould is removed, and the smoothly healed hollow is annexed to the eyehole in order to receive the eye-prosthese, which must be placed directly that the still elastic hollow can adapt itself to the prosthese form. It is now clear that the hollow must be constructed everywhere as near as possible to the mucous membrane."

Esser, in his article, forecasts considerable increase in the types in which this method will be useful, and already most valuable progress has been made in this respect. Major C W. Waldron, C.A.M.C., first undertook charge of the Face Injuries Service at West Cliff Canadian Eye and Ear Hospital. This service, in need of greater space, was later moved to a Canadian general hospital and later to the Queen's Hospital. Majors Gillies, R.A.M.C., and Waldron, C.A.M.C., have enlarged on Esser's methods, and given us a most valuable means of remedying many of the

war distortions of the lids by a method of epidermic outlay as compared with Esser's epidermic inlay. Waldron has modified Esser's method by making the incision in the conjunctival sac instead of through the eyelid skin; an impression compound mould is made, covered with the skin-graft and buried in the manner described, except that over the mould are sutured the cut margins of the conjunctiva. Waldron suggests undercutting the tissues of the cavity a little so as to make the cavity somewhat larger than the desired enlargement of the sac. He also suggests that in many cases it is found difficult to make the incision close to the tarsus. In making an inferior fornix he overcomes this condition by making an incision outwards and slightly downwards for a distance of 1 cm. from the external canthus. This modification has the following advantages in his words:

> "(1) Unnecessary scarring of the eyelids is prevented and the normal elasticity of the skin not impaired. As it is not uncommon to have an accumulation of serum develop around the buried graft, sutures may give way and slight infection may take place without impairing the success of the graft. These minor complications, however, in the case of inlays buried through an incision in the eyelid skin, may lead to granulations and scarring, and in rare instances epithelialised fistulæ have developed, necessitating operative excision and closure.
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> "(2) The exact position of the new fornix may be better outlined by an initial incision through the conjunctiva than by the undercutting to a point just beneath the surface of the conjunctiva. In our experience the fornix may be made closer to the tarsal plate by incising through the conjunctiva.
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> "(3) The depth and direction of the cavity can be readily determined according to the necessity of the individual case."

Major Gillies, R.A.M.C., has made two modifications of the Esser process. The first method consists in the

graft-covered mould being buried in the subcutaneous tissues of the eyelid through an incision in the skin, and is removed through that incision. By this method the eyelid skin is increased to the extent of the graft. This is especially useful in contractions following burns. The second method may be termed an epithelial overlay. Here extensive undercutting may be necessary before the remains of the eyelid can be brought to the normal position, and the covering in of a graft-covered mould is impossible. "After the remains of the eyelid have been sewn in a favourable position, scars excised and an impression taken of the entire raw area, Thiersch graft is then applied to the raw area and held firmly in place by means of the compound impression. This may be left in position for ten or twelve days. By this procedure the employment of pedunculated flaps may be avoided in many cases."

Pte. M. W— was sent to West Cliff for repair of his right socket to enable him to wear a glass eye. After the usual preparation and under an anæsthetic an incision was made along the lid margin the entire length of the damaged third of lid, the edges were separated, and dissection was continued to a depth thought necessary. The cavity was then fitted with a mould of sterilised dentist's compound and sutures loosely put in place through the lines of incision. When the compound had been pared to the proper size, a Thiersch graft was obtained from the arm and wrapped around the compound with the skin surface next to the compound. This was then placed in the cavity, which had been thoroughly dried; the sutures were drawn so as to keep the compound firmly held within this cavity. Ten days later the stitches were removed, the compound taken out; the graft had united entirely, the desired line of the lid had been repaired, and the patient was able to wear a glass eye.

Spr. W. M—, service of Capt. W. E. Ainley, with left anophthalmos, was unable to wear a glass eye on account of the shallow nature of the lower conjunctival

cul-de-sac. Line of incision along the lower palpebral conjunctival sac was made, an epithelial inlay set in on compound and sutured. The compound was removed ten days later; the epithelial inlay had entirely taken, and made the wearing of a glass eye a simple matter.

These two cases will, perhaps, suffice to give you some idea of what can be done in the repair of the lids by epidermis inlay and outlay. These methods offer much to ophthalmic surgeons. The results obtained in extensive ectropion following burns by the epidermis outlay technique of Gillies are most satisfactory. Equally so are the results obtained by the epidermic method of Waldron in injured lids and in shallow and distorted conjunctival sacs. The development of military ophthalmology along these lines has been extensive indeed. The repair and even the re-formation of the whole lid, as well as the repair of the conjunctival *cul-de-sac* by the Esser, Gillies, and Waldron methods, marks an epoch in ophthalmic surgery.

So much for some aspects of military ophthalmology. The subject is so large I have only been able to touch here and there on some of the essential features. I hope, however, that I have been successful in drawing your attention to what an essential part of military medicine ophthalmology really is.

It is to the credit of the Canadian Army Medical Service that at a very early period of the war the necessity for a special hospital was noted, and that in October, 1915, the West Cliff Canadian Eye and Ear Hospital was opened with a capacity of 105 beds. There were 3 administrative and 4 medical officers, 10 nursing sisters, and 27 other ranks. From that beginning the hospital has increased until at the present time it has an establishment of 400 beds, 12 officers, and 40 nursing sisters. There have been admitted to hospital 9854 cases, and there have been 49,906 consultations in the out-clinic department. Here are prepared the special reports so essential for medical boards, for categorisation, for

pensions, and for the final disposal of men. Much credit is due to Col. J. D. Courtenay, of Ottawa, who, by his initiative, had a great deal to do with the establishment of the hospital. By his persistence he saw that it was properly equipped, and by his foresight made the necessary accommodation for its possible growth. The hospital was originally intended to be the head of the Canadian ophthalmic service, where civilian ophthalmologists would be sent for military training. Unfortunately, war time is one of changes. We are, however, practising military ophthalmology in as conservative and in as scientific a manner as possible. We have all the equipment, including library and laboratory, necessary for such work, and hope a sufficient number of civilian ophthalmologists are being trained for useful military duty. These officers will later be looked to to decide many important questions: What eye injuries and diseases are due to service? What is the relationship between wounds of the cranium and defective vision? Soldiers with loss of central vision and no macular changes: is this due to service, and is it pathological or functional? What injuries are due to "windage"? What is rational treatment for malingering, functional amblyopia, war neuroses? What is the amount of disability due to hemianopsia? All these, of a professional nature, and more, and many medico-legal ones, are questions which must be decided by us with fairness to the individual and to the State.

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4. *On entoptic vision.—A new entoptiscope.*

By Sir W. F. Barrett, F.R.S.

The author gave a brief history of entoptic observation—that is, the subjective observation of objects within the eyeball, of which the *Muscæ volitantes* are the most conspicuous examples. To Sir D. Brewster and Dr.

Mackenzie, of Edinburgh, to Listing and Donders on the Continent, and Dr. Yago, of Cornwall, we owe some of the principal contributions to this subject. The discovery of the ophthalmoscope led to the abandonment of the subjective method of observation, and it was practically forgotten, although its importance was recognised long ago.

In 1905 the author noticed certain permanent obscurities in his own eyes whenever a brilliant spot of light was viewed. Using a minute illuminated pinhole in a metal screen he drew these obscurities and showed them to his friend, Dr. Charles Fitzgerald, the eminent Dublin ophthalmic surgeon ; a few months later Dr. Fitzgerald discovered incipient cataract in both the author's eyes, and drew what he observed through the ophthalmoscope. These drawings corresponded with those made by the author, the latter, however, giving far more detail.

The author then constructed an *Entoptiscope* and patented the apparatus in 1905, at the time being unaware that a simple form of this instrument had been devised before the discovery of the ophthalmoscope ; but no record of the use of entoptic vision for the observation of cataract appears then to have been made before the author's investigation of the subject. From 1905 to the present time the author had periodically drawn the slowly increasing cataract in his own eyes, and observed some curious fluctuations in the obscurities. By means of two pinholes, each about $\frac{1}{10}$th of a millimetre in diameter and 2 mm. apart, a double overlapping image of the pupil can be seen and drawn on the ground glass screen of the entoptiscope. In this way the exact distance of the obscurity from the retina of the observer's eye can be determined, and the method of calculation was explained by the author.

Whilst this subjective method of examination can never replace the ophthalmoscope, it is of great value in pupillometry, in class teaching, in the delineation

by the observer of minute obscurities in the eye and in the structure of the lens, and in the measurement of the field of vision, etc. In all entoptic phenomena the shadow of the obscurity projected outside the observer's eye is inverted both vertically and laterally, and magnified in the ratio of the distance of the eye from the screen, on which the image is projected, to the distance of the nodal point from the retina, which in a normal eye is about 15 mm.

Other entoptic phenomena were described by the author and their mode of observation, the most interesting being the moving corpuscles, which can be best seen by looking at a bright cloud through a blue glass. These corpuscles the author has carefully measured, and found them to correspond in size to the white corpuscles in the blood. They are doubtless due to the white corpuscles in the blood moving in the finer capillaries on the retina; their activity and number in a given area can be determined and may form a useful method of diagnosis, though unfortunately it is subjective.

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5. *Some observations on herpes zoster ophthalmicus.*

By Lieut.-Col. R. H. Elliot, I.M.S. (rtd).

My attention was attracted many years ago to the comparative frequency of cases of herpes zoster ophthalmicus in Madras. This led me to draw up a schedule embodying the principal points in connection with the disease as a basis for note-taking in these cases. Between November, 1909, and March, 1913 (a period of three years and four months) twenty-one records were obtained; it is probable that a few cases escaped observation in the heavy press of work in the Madras Hospital. The figure for the relative incidence of this affection taken on the out-patient record would work out at about 1 in 2500. Looking back, one gets the impression that the affection

is much more frequent in Madras than these figures would seem to indicate, but this is probably due to the fact that all cases of the kind were culled out from a great mass of others in order that special attention might be devoted to them. The very striking nature of the symptoms presented was doubtless another factor in accentuating the attention they attracted.

These notes have long lain by me, and I have felt that the number of cases was not sufficient to justify their publication. I have gone back from that standpoint for several reasons: (1) It seemed a pity to waste a quantity of material, for the collection of which I was indebted to my very excellent staff in Madras. (2) There are points in which the disease in India appears to differ from that met with in Europe. It is one of the advantages of having seen work in different parts of the world that one is able to appreciate the extraordinary varieties presented in different practices. What is rare in the East is common in the West and *vice-versâ*. (3) I have a suggestion to offer you on the subject of treatment which I have found of the greatest value, and which I believe to be practically unknown. (4) Last, but far from least, your Secretary demanded a paper of me, and I had no course but to comply I could only wish that he were equally firm with some of you.

Duration of the affection before the patient came under observation.—This varied greatly in different cases; in 4 it was less than a week; in 3 it was from one to two weeks; in 4 from two to four weeks; in 4 from two to three months; in 1, ten months; and in 5 the exact time is not stated, though in 4 of them it was said to have been a long time. Two interesting points appear in these records: (1) The relatively long period that many of the patients put up with the pain of this affection before coming for advice, and (2) the vagueness of many of the histories given. These are both common features of Oriental medical practice. The distances the patients have to come are often very great; their means do not

always allow them to come as soon as they would; the apathy and indifference to the pain of others, engendered by the ekeing out of an existence in the neighbourhood of starvation point, and blind Oriental fatalism must be taken into account in explaining the delays, whilst ignorance and lack of cultivation of the powers of observation account for the vagueness of many of the statements.

Age.—Of the 21 Indian cases, 6 occurred between 20 and 30 years of age; 2 between 30 and 40; 8 between 40 and 50; 4 between 50 and 60; and 1 between 60 and 70. These figures do not support the accepted view that this is a disease of the broken-down and of the advanced in life.

Sex.—Of the same 21, 17 were males and only 4 females. This very high percentage of men over women cannot be explained by the reluctance of the latter to resort to hospitals; the disparity is too great, and suggests the influence of an ætiological factor.

E. Disson (*Klin. M. f. Augenh.*, vol. lii, p. 902) found that of 28 cases, 22 occurred in males and only 6 in females. B. Chande (*Ann. of Ophthalmology*, vol. xxiv, p. 693) quoted 6 cases, 4 of which were in males and 2 in females. The percentage of women works out in Disson's figures at 21·4 per cent., and in my own at 19 per cent. The closeness between them is really remarkable.

Side affected.—The herpes was right-sided in 13 and left-sided in 8.

Race.—Of the 21 patients, 2 were Europeans; 2 more were of mixed parentage; 9 were caste Hindoos; 6 were what is known as other castes—that is to say low-caste Hindoos; and only 2 were Mohammedans. The last item is the most striking feature of this group.

Occupation.—The patients were drawn from all ranks of society and from all forms of occupation: 3 were clerks; 3 labourers; 2 mechanics; 1 was a policeman; 2 were sailors; 1 was a Sepoy; 2 were signallers; and 1 was a servant; 6 had no definite occupations.

Place of residence.—Of the 21 patients, 10 came from

Madras itself or from its purlieus; the rest came from districts outside, but no endemic centre could be traced.

Seasonal incidence.—In 2 of the 21 cases, the date of commencement of the infection escaped note; of the remaining 19, 14 occurred in the Indian cold weather, *i. e.* from November to March; the remaining 5 began at some time between June and September, in the rainy season. The hot-weather months of April and May and the month of October were free of cases.

Vision.—The great severity of these cases is best shown by an examination of the visual power possessed by them at a late period after the affection. In only 1 was the vision $\frac{6}{6}$; in 8 it ranged from $\frac{6}{12}$ to $\frac{6}{60}$; in 5 it was "very deficient"; 2 could count fingers at short distances; 2 could distinguish hand-movements; and 3 were blind or nearly so.

Affection of other branches of the fifth.—In two patients the herpetic eruption affected the cheek of the same side over a wide area; another complained of pain on the inner surface of the pinna in the neighbourhood of the tragus; whilst in a fourth the notes record herpetic eruptions scattered widely over all the branches of the fifth nerve. The last-named observation is deserving of notice, for it appears to be the universal experience that a herpetic affection of the third branch of the fifth nerve is a very rare event indeed.

Affection of other nerves.—In two patients the external rectus suffered paralysis. In the first of these the temperature on the second day of the attack was 103·6° F., and there was great œdema of the whole side of the face; seven days later the external rectus was found to be paralysed, and remained so during the twenty-three days that it was possible to keep him under observation. In the second case, a male, æt. 22 years, came under treatment after the eruption was completely healed. He was very vague as to details. He was lost sight of for a fortnight, when he returned with a complete paralysis of the external rectus. He speedily disappeared again. In not one single

case was there any evidence of paralysis of the third nerve, with the exception of one patient, who presented a widely dilated pupil and a sluggish iris.

Clinical Signs and Symptoms.

Neuralgia.—Of the 21 patients, there were only 3 who did not suffer from neuralgia before the herpes made its appearance; one of these 3 complained of some neuralgia after the herpes had come out. All these 3 were light cases, as evidenced by the slightness of the local swelling and the absence or moderate degree of pyrexia present. The appearance of the eruption seems usually to have been coincident with a considerable abatement in the neuralgia, for after it had appeared there is a note of severe pain in only 7 of the cases as against 18 beforehand.

Local swelling.—This varied greatly. In 4 it was very severe—the appearance in such cases is almost erysipelatous; in 5 it was moderate; in 5 it was slight; and in 7 it was either absent or not recorded—the probability is that in all these cases it was slight and escaped the patient's observation, or, more likely, his memory at the late stage at which he came.

The skin and other areas affected.—A place was reserved in our schedule for each area according to the anatomical distribution of its nerve supply:

Forehead: The supra-trochlear, 19 cases.
Supra-orbital, 18 cases.
Lacrymal, 14 cases.

Lids: Supra-trochlear, 14 cases.
Infra-trochlear, 5 cases.

Nose: Infra-trochlear, 15 cases.
Nasal cutaneous, 13 cases.
Nasal mucous, 14 positive and 4 doubtful cases.

Conjunctiva: In all cases.

Cornea: Definitely affected in 19; doubtfully in 2. In the 19 nebulæ or leucomata, or active ulceration, were present; in 1 there was striped keratitis; in

another vesicular keratitis; in another pannus; in 1 the whole cornea was opacified; in 4 there was evidence of perforation of the cornea, and in 1 of these panophthalmitis had occurred.

Interference with sensation.—The skin over the affected areas was found to be anæsthetic in 7 cases, hyperæsthetic in 5, both hyperæsthetic and anæsthetic in 4, doubtfully anæsthetic in 2, and unaffected in 1; the condition was not noted in 2 cases. The condition of mixed hyperæsthesia and anæsthesia is a curious one. It would perhaps be more correct to speak of it as delayed sensation; after the skin area is touched there is a very distinct delay before any sign of appreciation of the touch is shown, and then the patient starts and complains of pain. The conjunctiva was anæsthetic in 15, doubtfully so in 3, and normal in 1; in 2 no note was made. The cornea was anæsthetic in 19, and hyperæsthetic in 1, when seen during the attack.

The eruption of the vesicles.—Out of the 21 patients, 9 could not remember exactly how the eruption came out; 4 stated that it all appeared at once; in 2 it had come out in two groups; in 2 in three groups; in 1 in four groups; in 1 in six groups; and 2 could only say that it had come out in a number of groups. Some interest attaches to the description of the appearance of the rash by certain of the patients. One stated that the first crop affected the left side of the nose, the second crop affected the left side of the forehead, and the third the upper eyelid (left). The first crop was much the most abundant. Another patient, who likewise had three crops, stated that the first affected the area near the middle line, and the later ones spread further and further outwards. Some of them stated that several crops appeared in the course of a very few days, sometimes in only three or four days, whilst others averred that two or three days elapsed between the appearance of each of the crops.

One patient presented a cicatricial contraction of the inner half of the margin of the upper lid; this was

evidently the outcome of a very severe herpetic ulceration; the cutaneous surface was much pigmented, and over the cicatricial area the lashes were absent. Heavy pigmentation of the areas affected by herpes is very common in Indian cases. In another patient there was found a cicatrising ulcer of the mucous membrane of one nostril. Such instances of extensive destruction are rare in the literature of the subject, but E. A. Clarke (*Ophthalmic Record*, 1910, p. 174) records the case of a man, æt. 80 years, in which an attack of herpes zoster ophthalmicus caused the destruction of the whole thickness of the upper lid at one spot; a hole resulted, through which the cornea was exposed, severe damage to that structure being the consequence of this want of protection.

Alterations in tension.—In one of the twenty-one cases there was a marked increase in the tension of the eye; the Schiotz tonometer reading indicated an intraocular pressure of 45 mm. Hg. The chamber was deep; the cornea was anæsthetic and presented superficial opacities. The herpetic attack, which appeared to have been of moderate severity, was practically at an end when the patient presented himself. He was a male Hindu, æt. 50 years.

Records of low tension are comparatively frequent, and indicate a falling off in the physiological activity of the ciliary body, doubtless associated with keratitis and irido-cyclitis.

In only one case was the tension recorded as subnormal apart from evidence of severe keratitis, irido-cyclitis, or panophthalmitis. The patient was an Eurasian female, æt. 53 years. Severe headache preceded the eruption, but otherwise the attack seems to have been a mild one, and limited to the areas of distribution of the supratrochlear and infratrochlear nerves, and to small superficial ulcerations of the cornea; the pupil was widely dilated, and its light reaction was very slow; the vision of the eye was $\frac{6}{60}$, and the tension, as recorded by the Maklakoff tonometer, was only 7 mm. Hg. Presumably the function of the ciliary body had been markedly impaired.

A number of cases both of hypertension and of hypotension after herpes ophthalmicus are on record. Amongst the contributors to the former complication are J. E. Weeks (*Ophth. Record,* August, 1917), three cases; V. Morax (*Ann. d'Oculistique,* vol. cliii, 1, p. 186), two cases; A. A. Bradburne (*Ophth. Record,* April, 1909), one case; and F. Verderame (*Ann. de Ott.,* vol. xlii, p. 772), one case.

It has long been known that attacks of herpes zoster ophthalmicus are sometimes complicated with paralyses of one or another of the cranial nerves, and especially of the third, fourth, and sixth. Fage (*Rec. d'opht.,* 1909, p. 209, quoted in the *Ophthalmic Year-Book* for 1910, p. 76) speaks of partial and complete paralyses of the third nerve, of exceptional paralyses of the fourth and sixth nerves, and of occasional instances in which all the ocular-muscles are paralysed together. He states that slow but complete recovery is the rule.

J. R. Hunt (*Journ. Am. Med. Ass.,* October 30th, 1909) collected 158 cases of paralyses of various kinds in association with herpes zoster of the head and neck; of these 18 involved the third nerve, 1 the fourth, and 5 the sixth.

R. B. Metz (*Ohio State Med. Journ.,* December, 1913, and *Ophthalmology,* April, 1914) reviewed the literature of herpes complicated by ophthalmoplegia; he found 50 cases: 32 of the third nerve, 4 of the fourth, 8 of the sixth, 5 of all three, and 1 not stated; the paralyses of the third nerve were total or partial, various muscles being selected and only 25 per cent. of them being complete. Recovery occurred in the majority of the cases. There are also a number of isolated cases scattered throughout ophthalmic literature.

It is interesting to observe that, whilst in the 21 cases under review there were 2 instances of paralysis of the sixth nerve, and 4 others in which branches of the fifth other than the ophthalmic were attacked (one of them affecting all three divisions of the nerve), there was not a single case of involvement of the third or

fourth nerves. This may be an outcome of dealing with small numbers, but it is a sufficiently striking coincidence to deserve some notice. The relative frequency of affection of the sixth nerve is extraordinarily high, apart altogether from the coincident absence of third nerve trouble. The number of cases in which branches of the fifth nerve were affected in these patients is a very remarkable feature, made still more so by the fact, to which attention has already been invited, that in one of them all three branches of this nerve suffered.

Another peculiarity of these Indian cases is the extraordinary frequency, almost amounting to uniformity, with which the cornea was affected. In this connection there are several points to notice: (1) That the corneal sensibility was diminished in 20 out of the 21; (2) that in 19 of them there was definite evidence of corneal lesion, past or present; (3) that these corneal lesions were of a severe nature in no less than 8 of the 21; (4) that in 16 of the 21 there were herpetic eruptions along the course of some one or more of the branches supplied by the nasal nerve to the skin and to the mucous membrane of the nose; and (5) that the conjunctival sensibility was certainly diminished in 15 cases and doubtfully so in 3 more.

Corneal complications would appear to be much less frequent in Europe than in India. A good deal of stress has been laid upon the connection between these complications and the appearance of a rash along the cutaneous and mucous membrane branches of the nasal nerve. Without in the least wishing to cast any doubt on this connection, I should like to record the opinion that in few, if any, cases of herpes zoster ophthalmicus will the sensibility of the cornea be found absolutely normal if it is carefully tested at intervals during an attack. I base this observation not only on my Indian experience, but also on those few cases which I have seen in Europe.

Ætiology.—Herpes zoster ophthalmicus has sometimes

been ascribed to the continued use of arsenical preparations. In not one single one of these cases was there any evidence in support of such an idea. On the other hand, what has been said about the value of Donovan's solution goes to show how unlikely it is that arsenic is a causative agent in the production of this affection. One wonders whether the origin of the idea may be traceable to some condition for which arsenic has been given on empirical grounds. It seems not impossible that the herpes may be a complication or an outcome of some such condition, and that when it appears after the administration of arsenic it occurs in spite of, and not because of, the use of the drug. This idea borrows an interest from the fact that herpes ophthalmicus has sometimes been thought to have been due to malaria. It is easy in a country like India to ascribe any condition to paludism, and this is sometimes done without making due allowance for the fact that *post hoc* is not always *propter hoc*. It would be difficult to find a man or woman in the Madras Presidency who has not at some time suffered from malaria, but we were quite unable to satisfy ourselves that there was any real connection between the two conditions. Much the same might be written of influenza, to which herpes ophthalmicus has not infrequently been ascribed. Indeed, we have sought in vain for anything that would throw a light on the ætiology of this affection.

Treatment.—The outstanding feature of herpes zoster ophthalmicus is the excruciating pain which so often accompanies it. In the Indian cases, this pain, neuralgic in character, continues long after the complete healing of all the ulcers, and it often deprives the patient of his rest and takes away all the pleasure of life. My experience of the affection in India has been large as compared with that in England, but in the few cases I have seen here there has been this same character of persistent pain. Over twenty years ago I showed a case of the kind before the local branch of the British Medical Association

in Madras, and asked for suggestions as to treatment. The only one I received was a tentative one as to the advisability of trying Donovan's solution (liq. ars. et hyd. iod.). I acted upon this suggestion and found it of the greatest value. I have never since known it to fail when given properly, and I can recommend it most warmly to your notice, the more so as I have nowhere found it mentioned in literature, nor have I come across any surgeon who was aware of its value. I believe it to be a specific for the affection. It should be given at first in 10-minim doses thrice daily; each dose should be taken in half a tumbler of water three-quarters of an hour after a meal. At the end of the third day the dose should be raised 2 minims (*i. e.* to 12 minims thrice daily); at intervals of a few days the dose is raised minim by minim. Many patients will stand 20 to 30 minims or more and will greatly benefit in general health thereby. Any signs of nausea, vomiting or diarrhœa must be taken as an indication to stop the medicine for a day or two, and then to re-start it with lower doses.

The rapidity with which pain is relieved under this form of treatment is very surprising. I have notes of cases in which the neuralgia was markedly better at the end of the first twenty-four hours. It is more difficult to be sure that the drug plays a definite part in expediting recovery from the disease, but it is certainly my impression that it favourably influences its clinical course. It is also quite certain that under this form of treatment not merely is the neuralgia relieved, but the hyperæsthesia of the skin disappears, and, in some cases at least, normal sensation replaces the pathologic anæsthesia. It would be impossible to speak definitely of the exact therapeutic value of the drug, unless one were prepared to run two series of cases side by side, the one with and the other without this particular form of treatment. This I have not done, nor should I feel justified in doing it, in view of the great relief of pain which is undoubtedly afforded by the line of treatment I have indicated. One great and

obvious value of the method is that, unlike the various forms of electrical treatment which have been advocated, it lies within the reach of medical men in any and every form of practice.

I understand that a similar neuralgic condition is found in herpes zoster of other parts of the body, and I cannot help thinking that Donovan's solution will prove equally efficacious in these as in the ophthalmic cases.

MIDLAND OPHTHALMOLOGICAL SOCIETY, 1917–18.

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REPORTS.

1. *The treatment of ulcus serpens of the cornea.*

By A. B. Cridland.

The subject for discussion is "The Treatment of Ulcus Serpens of the Cornea." Other terms by which this ulcer is designated are : "Pneumococcal," "Saemisch's ulcer," "typical hypopyon ulcer," and "serpiginous ulcer of the cornea." The last designation should be spoken of as acute, in contradiction to chronic serpiginous ulcer of the cornea, which is sometimes applied to Mooren's ulcer.

A hypopyon ulcer may occur which is due to the diplobacillus of Morax and Axenfeld, but I suggest that we confine ourselves to the typical hypopyon ulcer which is caused by the *Pneumococcus lanceolatus*, and although

occasionally it is almost impossible to differentiate clinically between the two types without a bacteriological examination, the treatment of the former is, as a rule, so satisfactory that there can be no difference of opinion as to the procedure to be adopted.

I say "as a rule," because occasionally an ulcer presents itself with the characters of a diplo-bacillary ulcer in which sulphate of zinc does not act so successfully as would be expected, and, again, what apparently is an ordinary pneumococcal ulcer responds in a striking manner to $ZnSo_4$.

Is it possible that in these cases we have to deal with a mixed infection? This is one point on which I invite discussion.

I presume that most of us see a good number of "pneumococcal" ulcers, and as, so far as I know, there has not yet been put forward any special specific treatment which acts in a favourably striking manner, we are all faced from time to time with what can only be described as tragic results.

With a view to obtaining some idea as to how bad these are I have examined our case-books over a period of twenty-seven months.

Sixty-seven severe hypypyon ulcers occurred during this time, and of these I have no hesitation in saying that the vast majority were due to the pneumococcus; I regret I cannot speak exactly on this point, as bacteriological proof is wanting.

The results were that enucleation was necessary in four cases, whilst the majority were left with more or less dense leucomata and consequent impairment of vision.

This may or may not be a record which compares favourably with those of other cliniques, but however it stands, it but serves to emphasise the generally accepted view as to the gravity of these ulcers.

The condition is a serious one to the labouring class of the community, to whom it is almost wholly confined, and it is one which demands all the more attention when the

loss of time from work, together with the subsequent handicap, are taken into consideration.

The mild cases may only require treatment for two or three weeks, the severe cases anything from one to several months.

Can we not do something more for these patients?

The consideration of the treatment naturally falls under the usual headings:

(1) *Preventive.*— Realising that all these ulcers are originally traumatic, and that infection takes place either from the conjunctival sac, the lacrymal sac, or by such foolish acts as rubbing the eye with fingers moistened with saliva, and others equally well known to us, cannot something more be done to warn the labouring class as to the dangers they run? The majority of cases come from those engaged in colleries, ironworks, and in agriculture: what steps are taken by those in authority in these employments? Very few, I think.

It seems almost a misfortune that the insurance against such occurrences is, as a rule, in the hands of an insurance company, for thereby the responsibility and expense are shifted from the shoulders of the employers to those of a wealthy company, whose very existence depends upon such happenings, and who thereby every year earn a large profit. From the surgeon's point of view the risk of a "watery" eye should receive more emphasis than perhaps it does.

(2) *Medical.*—I do not propose to go into detail as to the efficacy or otherwise of various kinds of lotions and drops. I presume that we all of us try new remedies from time to time, only to find that the older ones are as good as anything else up to now.

We have here tried solutions of acriflavine and brilliant green, but as these are chiefly effective only in the presence of much serum we have not expected much, and have not been greatly struck with their value in the treatment of pneumococcal ulcer, although we have found them very efficacious in burns of the conjunctiva and cornea.

(3) *Surgical treatment.*—Under this heading cauterisation by various means comes first. I do not think it matters very much what means we actually employ, provided we practise them in a scientific manner and sufficiently. There are as ardent devotees for pure carbolic as for the actual cautery, and probably one is as good or as bad as the other. There are many pros and cons to cauterisation, and it is well to remember that sometimes good results are obtained by simply desiccating the ulcer by dry heat with the actual cautery, not allowing it to touch it directly. This can be repeated frequently, and has the advantage of destroying the tissue much less than the usual method.

The variety of procedures which have been practised with cutting instruments leads one to think that there is no *operation de luxe*. To mention some, we have Saemisch's section, paracentesis of the anterior chamber with evacuation of the hypopyon, or drawing it out if too viscid to flow; Walker's operation of multiple punctures of the limbus, peritomy, and iridectomy.

One result which is common to all these operations is that of reducing the tension, and herein, I think, lies the success of all the surgical measures which involve opening the anterior chamber. The fact that Saemisch himself advised keeping open the section freely suggests that he wittingly or unwittingly aimed at keeping the tension down to or below normal. Again, the fact that the use of eserin occasionally is beneficial in clearing up the hypopyon is strongly suggestive that increase of tension is the obstacle to be overcome. It is well known, of course, that increase of tension is an indication of the severity of the ulcer, and, as bearing this out, I may say that out of the 67 cases which I have reviewed 21 showed high tension, including those which required enucleation. This is a point which, although mentioned by all writers on the subject, has not, I think, received half enough emphasis. We are all, I think, in agreement that the worst cases show high tension, and whether this is cause

or effect does not alter the fact that it is highly important to reduce it. A case cannot do well if the tension is raised, and early surgical measures should be adopted to reduce it, repeating them as often as may be necessary.

I believe myself that the presence or absence of high tension is the dominating factor with regard to prognosis in pneumococcal ulcer, and I shall be very interested to learn the views of others on this point.

Serum and vaccine treatments hold their place in the therapy, and, as an adjunct to the usual measures, may be of value. My own experience of this is small and disappointing, and I rather regret to say that I seldom even think of it now; theoretically speaking it is correct, but its limitations are obvious.

(4) *After-treatment.*—This is comprised of optical iridectomy—which I find excellent in some cases—and tattooing, the value of which is open to great question. In suggesting a discussion on this subject, the incentive in my mind has been the deplorable results so frequently seen in these cases, the problems they present with regard to treatment, and the growing conviction that the dominant factor in the prognosis is the presence or absence of increase of tension. I ask, Is it sufficient to deal with this complication by paracentesis, repeating it frequently if necessary, and this notwithstanding the evidence just brought forward by Treacher Collins with regard to the effects which follow the procedure in the normal rabbit's eye? or should we be more bold and perform an iridectomy early, or, perhaps, go to such lengths as trephining or performing a sclerectomy?

Mr. Jameson Evans used sulphate of zinc, methyl blue, quinine sulphate—ethyl-hydro-cuprein. He used to cauterise, but had lately given it up in favour of thermo-chauffage. He thought that eserin did much good in reducing tension. He had never seen much benefit from paracentesis, but he strongly advocated Guthrie's section.

Mr. Harrison Butler advocated Guthrie's section, in

that it opened up and drained the layers of the cornea. He pointed out the possibility of sympathetic disease occurring after section of the cornea, especially in cases where the iris became involved in the scar. He once had such a complication in Jerusalem.

Mr. ADAMS advocated the early application of the actual cautery, later thermochauffage. He recommended the use of eserin for the relief of high tension. Quinine and alcohol should be given internally.

Mr. ROBERTS advocated the application of solid dionine on to the conjunctival sac. It appeared to increase the lymph supply and hasten the removal of the sloughs caused by the cautery.

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2. *Statistics of glaucoma operations.*

By T. HARRISON BUTLER.

I MAKE a practice at the end of every two years of summarising the results of my total past operative work upon glaucoma, and the statistics which I now present to you embody the figures for the past ten years of my work. We discussed this subject about three years ago, and one of our members said that he did not think that this type of research had any practical value unless the tables took into account the duration of the disease in each case. Unfortunately, it is difficult to determine this point, nor is it stated in the notes of the majority of my cases. I think that a more vital objection is to be found in the fact that not by any means all of the patients have been followed up for a length of time sufficient to judge of the final result of the operation. Many of the cases do not attend regularly, and, even when written to, not a few have neither attended for examination, nor have they answered questions addressed to them.

I feel, however, that my statistics, incomplete as they are, have some value; they have proved of the greatest utility to me, and, acting upon such figures, I have

frequently modified my methods in drastic fashion, and have from time to time altered my views.

I have in the past had many discussions with Col. Elliot, both in public and in private, upon the comparative value of iridectomy and sclerectomy, and I wish to take this opportunity of stating that in the light of further experience with iridectomy and trephining, he has generally been correct in his opinions and I have been wrong.

The method employed in collecting the material upon which the statistics are founded is to take out the names of the patients from the operation-books of the hospitals in which I work, and then to collect all the case-books. The result tabulated is that found from the last note which has been made. Although, as I have stated, the last note may be far from being the final word, still it is the same for all the operations we are considering, and should yield valuable comparative data. I find that to the end of 1917 I have more or less reliable notes of 112 operations for chronic glaucoma, 37 for acute glaucoma, and 26 for mixed glaucoma. Under *mixed* I classify cases which are neither pure primary, acute, or chronic glaucoma. The class includes many cases of so-called subacute glaucoma, hæmorrhagic glaucoma, and some of secondary glaucoma ; many of them were desperate, and the operation was tried as the last hope of saving the eye.

The operations chosen have been : Iridectomy, 62 ; trephine, 62 ; Holth's punch, 39 ; Herbert's small flap, 7 ; scleral puncture, 4 ; and iris puncture, 1.

The results obtained are shown in the following abridged tables :

Chronic Glaucoma.

Operation.	No. of cases.	Vision improved.	Tension reduced.	Final good result.	Total loss.
		Per cent.	Per cent.	Per cent.	Per cent.
Sclerectomy .	82	72	74	64	6
Iridectomy .	30	57	64	43	3·3
All operations .	112	69	71	59	5·3

Acute Glaucoma.

Operation.	No. of cases.	Vision improved.	Tension reduced.	Final good result.	Total loss.
		Per cent.	Per cent.	Per cent.	Per cent.
Sclerectomy .	6	83	83	83	0
Iridectomy .	28	93	86	86	3·5
All operations .	37	94·5	86·5	86·5	2·7

Mixed Glaucoma (Secondary, Subacute, Hæmorrhagic, etc.).

Operation.	No. of cases.	Vision improved.	Tension reduced.	Final good result.	Total loss.
		Per cent.	Per cent.	Per cent.	Per cent.
Sclerectomy .	21	86	81	81	14
Iridectomy .	4	50	100	75	25
All operations .	26	80	84·5	81	15

The high percentage of total loss in this group is due to the fact that many of the operations were performed as a last hope before enucleation.

A summary of the original unabridged tables gives the following percentages of good results:

	Trephine.	Holth.	Iridectomy.	Herbert's Flap.
	Per cent.	Per cent.	Per cent.	Per cent.
Chronic glaucoma .	63·5	66·7	43·4	50
Acute glaucoma .	83·3		85	—
Mixed glaucoma .	81		75	—

It will be at once seen that sclerectomy in chronic glaucoma is superior to iridectomy by over 20 per cent. The punch operation gives better results than the trephine as regards actual statistics, but I have had to abandon it because of the frequency with which late infection has followed the operation. I believe that the better decompressive action is due to the fact that fewer of the punch

apertures than trephine holes heal up solidly. This can and will be remedied by using the 2 mm. trephine instead of the 1·5 mm., which has up to the present been my favourite size. Here we at once see the value of statistics; they have led me to the view that the larger instrument is the best.

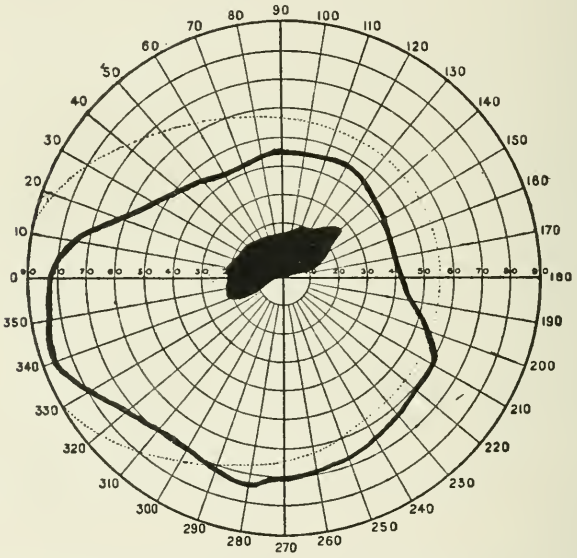
In acute glaucoma the results of sclerectomy and iridectomy are practically the same. I therefore still employ iridectomy for the majority of these cases, reserving the trephine for patients who have had the acute condition for over a week, or when the acute condition is an exacerbation of a chronic disease. I have recently had several cases of neglected acute glaucoma in which, although the iridectomy has relieved the congestive symptoms, yet the tension has not been normalised, and trephining has been performed later on. In future I shall trephine at once in this type of glaucoma. Mr. Wood White tells me that he has had a similar experience, and that in consequence he is using the trephine more and more in acute cases.

Late infection.—Excluding ambiguous cases, some of which have been objected to by Col. Elliot, I have had three examples which have led to the total loss of an eye. They have all followed the Holth punch operation. I explain them by the fact that the female blade of the punch is liable to press upon the reflection of the conjunctiva and diminish its nutrition. In two cases there was an actual perforation produced by this action. I found that I had either to abandon the attempt to get the aperture well forward or to run this risk. I have therefore, entirely given up the operation. I am now also disposed to agree with Col. Elliot in his contention that it is a more difficult and dangerous operation than trephining. At one time I maintained the opposite view, but now that I have my own trephine to work with I prefer trephining even from the standpoint of simplicity.

Six of my patients have suffered from what we can either describe as a mild late infection or as a recurrent iritis. Two of them have had repeated attacks. The

symptoms are characteristic. There has generally been a hypopyon, and the area over the fistula has been swollen and yellow in colour. All these cases have looked very alarming, but they have recovered with great rapidity under the action of atropine and the hot box. Four of them have been associated with the punch operation, and only one with the trephine. It is obvious that the danger

Fig. 55.—Left eye.



Shows a central scotoma coming close to the fixation point. Taken with the Priestley Smith perimeter.

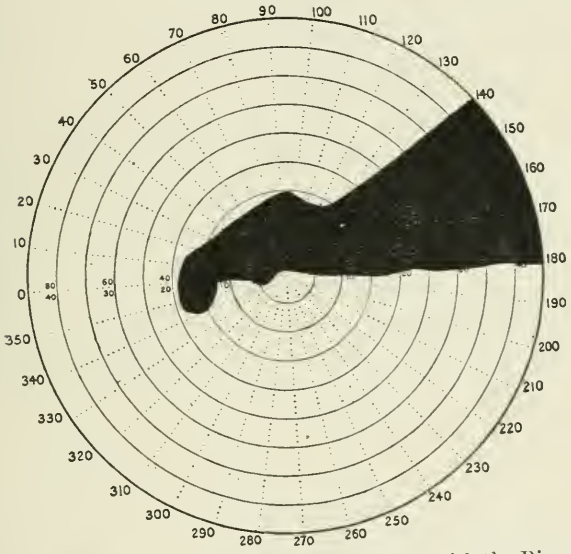
of late infection is vastly greater after the punch than the trephine.

Defects of the trephine operation.—I consider that trephining is the best operation that I have performed for chronic glaucoma, and yet it seems to have grave defects. The serious objections are the following: The difficulty of obtaining an ideal scar; the liability of the lens to come forward, and delay in the re-formation of the anterior chamber; the resulting alteration in the refraction; soft

eyes, which seem more liable to late infection than eyes with a normal tension; the liability to cataract.

The scar.—It seems to be almost impossible to promise an ideal scar. Quite a large number of the operations result in solid healing, generally followed by a rise of tension. In one case, a most desperate one, I only succeeded in obtaining filtration at the third attempt;

FIG. 56.



Shows the same scotoma seven months later, taken with the Bjerrum screen. Scale 1 mm. = 1°. White 2 mm. object. These figures demonstrate how trephining may preserve the central vision in a desperate case. It also shows how a Bjerrum scotoma may menace central vision although the peripheral field remains full, and hence the necessity for the use of the screen in all cases of glaucoma.

several others I have trephined twice. Then an apparently exactly similar operation yields a large ectatic scar. In a small proportion of the operations a hard, solid lump forms over the trephine hole. At present we cannot be certain of the type of scar which we shall obtain, but doubtless in time an improved technique will give more regular results.

Delay in the formation of the anterior chamber.—In not a few cases the anterior chamber remains very shallow and the lens comes forward. Generally at the end of a fortnight the chamber re-forms, but it may be some weeks before the myopic refraction disappears. This is a most anxious complication. I have seen it after iridectomy, but it is far commoner after sclerectomy.

Soft eyes.—Treacher Collins has pointed out the dangers of the hypotonic eye. I will only add the fact that in two of my fatal cases of late infection the tension was very low—in one case 4 by the Schiötz scale. As a matter of fact, the soft eye is not very common after trephining.

Cataract.—Five or six of my trephine cases have developed a nuclear cataract. This has come on rapidly after the operation, and has generally been most dense in the lower segment. It is not a traumatic cataract. In other cases there have been vitreous opacities which have diminished the acuity.

Iritis.—I have had very little iritis after my trephine operations, and it has been of a very mild type. I always instil atropine the day after the operation, and if this be done I do not think that iritis can be urged as one of the ill-effects of the method. I think that the greatest care must be taken not to lose vitreous. Practically all my cases which have had this complication have been failures. In some cases of chronic glaucoma with a long history it may be impossible to dissect the flap of conjunctiva well into the cornea. The trephine hole must perforce be made further back than is desirable. Then a button of the iris root or even the ciliary body presents in the hole. Leave it alone. If it be snipped with the scissors vitreous will escape. Probably the iris will act as a plug, but the loss of vitreous is almost a certainty, and then the operation fails. I have urged that iridectomy may be made the primary operation, because it is easy to trephine if the first operation fail to relieve tension. It is not easy. I have found that in an eye which has had any previous operation it is exceedingly difficult, if not impossible, to

reflect the flap as far as desirable. This is the case even when the second operation is performed at a different site. There seems to be some inflammatory process which causes some adhesion of the conjunctiva at the limbus. I am not aware that sections show this, but I have found it clinically.

In conclusion, the result of the examination of my very latest figures shows that the effect of the trephine operation is superior to that of iridectomy in chronic glaucoma to such a degree that I have abandoned the latter operation, and reserve it only for recent examples of the acute disease. The work which I have done this year entirely confirms this opinion. I have been able to examine cases I have trephined four and five years ago. In some of them a large Bjerrum's scotoma which was then dangerously near the fixation point has remained almost stationary, and good vision has been maintained. In others, fields the size of a shilling have not got smaller, and the central vision has remained good. I think that 65 per cent. of cures may be claimed for the operation, and that when it is done early in the disease the percentage will be even higher.

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3. *Three cases of hereditary cortical cataract, with a chart showing the pedigree of the family in which they occurred.*

By A. B. Cridland.

Investigations had been made extending over five generations, from the end of the eighteenth century up to the present time. Among 56 members of the family 23 were known to be affected—a number of whom had been operated on by him—23 were unaffected, and no information had been obtainable in 10.

The type of cataract was peculiar, and invariably appeared as dense white striations in the anterior and posterior cortex, the polar areas often presenting a Y-shaped opacity, and the vision was reduced to an

extent to incapacitate the patient from work long before maturity. Appearing usually before the age of ten, and, in a few cases, before the age of five, there was a rapid advance up to twenty, and the majority of the cases were operated on between twenty and thirty. Good visual results were obtained after simple extraction of the lens, and no special difficulties were experienced in the operation.

INDEX.

PAGE

ADAMS (Capt. P. H.), ophthalmology and the war . . 316

Balance-sheet 288
BARRETT (Sir W. F), entoptic vision: a new entoptiscope . 349
BATTEN (F. E.), two cases of "epidemic stupor" with ophthalmoplegia 172
BERRY (Sir George), discussion on the effects of hypotony in rabbits' eyes 224
Bjerrum's sign 185
Botulism 168, 173, 176
Bowman Lecture, rules of . . . xxxviii
——— Lectures iii
British Army, standard of vision in the; report of the Committee on the conditions affecting it . . . 130
British Journal of Ophthalmology: procedure arranged with the Ophthalmological Society and the journal . . 2
BROOKSBANK (James), discussion on a new form of scotometer 210
——— ——— ring-sarcoma of the optic papilla . . 163
BUTLER (T. Harrison), discussion on dioptric mean in myopia. 258
——— ——— a new form of scotometer . . . 210
——— ——— plastic operations of the eyelids . . 107
——— ophthalmology and the war . . . 315
——— statistics of glaucoma operations . . . 368

Cataract, cortical, hereditary, three cases of (A. B. Cridland) . 375
Cerebral tumour, papillœdema in (Leslie Paton) . . 170
Cervical rib, sympathetic paralysis associated with (M.S. Mayou) 178
CLARKE (Ernest), discussion on purulent ring infiltration of the cornea following "mustard gas" . . . 150
CLEGG (J. Gray), case of double homonymous lateral hemianopsia 182
——— ——— monocular traumatic altitudinal hemianopsia . 179

PAGE

CLEGG (J. Gray), discussion on plastic operations of the eyelids 115
——— ——— suture operation for contracted socket . 122
——— ophthalmology and the war . . . 323
COLLINS (E. Treacher), an experimental investigation as to some of the effects of hypotony in rabbits' eyes . . 217
——— bilateral multiple angiomata of the retina . . 165
——— case of epibulbar sarcoma cured by removal and the application of radium 125
——— discussion on a new form of scotometer . . 211
——— ——— contagious diseases of the conjunctiva . 46
——— ——— case of cryptophthalmos . . . 145
——— ——— histology of the trephined disc in glaucoma . 245
——— Presidential address 1
COLLINS (Sir William), Doyne memorial lecture: ophthalmology and the war 292
Colour and light, suggested clinical tests of the threshold of (George Young) 279
Congenital abnormalities 142
Conjunctiva, contagious diseases of the, discussion on . 9
——— diseases of the 119
——— papilloma of the (M. L. Hepburn) . . . 124
Contagious diseases of the conjunctiva, discussion on, opening papers by J. B. Story, 9; S. Stephenson, 11; F. J. Cunningham, J. Wharton, 18; H. L. Eason, 30; E. Treacher Collins, 46; Col. W. T. Lister, 52; Capt. M. L. Hine, 53; A. F. MacCallan, 54; F. A. C. Tyrrell, 59; M. S. Mayou, 61; J. B. Story, 63, 68; Lieut.-Col. Elliot, 64; Major Derby (U.S.R.), 66; D. V. Giri, 67.
——— resolution on the subject 69
Cornea, bilateral superficial symmetrical opacities of the (D.V. Giri) 147
——— diseases of the 147
——— purulent ring infiltration of the, following "mustard gas" (M. S. Mayou) 149
——— ulcus serpens of the (A. B. Cridland) . . 363
Corneal degeneration (M. S. Mayou) . . . 148
Council, report of the 286
CRIDLAND (A. B.), three cases of hereditary cortical cataract . 375
——— treatment of ulcus serpens of the cornea . . 363
CROSS (F. Richardson), discussion on dioptric mean in myopia 259
CRUISE (Capt. R. R.), a further note on the visor . . 250

PAGE

Cruise (Capt. R. R.), discussion on dioptric mean in myopia . 258
——— ——— plastic operations of the eyelids . . 114
——— ——— purulent ring infiltration of the cornea, following "mustard gas" 150
——— ——— histology of the trephined disc in glaucoma . 247
Cryptophthalmos, case of (W. Sinclair) 142
Cunningham (J. F.), discussion on contagious diseases of the conjunctiva 18

Derby (Major), discussion on a new form of scotometer . 210
——— ——— contagious diseases of the conjunctiva . 66
Dioptric mean in myopia, with reference to military requirements (W. Wallace) 254
Doyne Memorial Lecture, ophthalmology and the war (Sir William Collins) 292

Eason (H. L.), discussion on contagious diseases of the conjunctiva 30
——— military ophthalmia in Egypt . . . 30
Egypt, military ophthalmia in (H. L. Eason) . . 30
Elliot (Lt.-Col. R. H.), discussion on a case of cryptophthalmos 146
——— ——— contagious diseases of the conjunctiva . 64
——— ——— effects of hypotony in rabbits' eyes . . 223
——— histology of the trephined disc in glaucoma operations 227
——— on a new form of scotomotor and a sign elicited by its use 185
——— on ophthalmology and the war . . . 311
——— some observations on herpes zoster ophthalmicus . 351
Entoptic vision—a new entoptiscope (Sir W. F. Barrett) . 349
Epibulbar sarcoma, case of, cured by removal and radium (E. Treacher Collins) 125
"Epidemic stupor" with ophthalmoplegia, two cases of (F. E. Batten) 172
Eyelids, plastic operations of the, discussion on . . 70

Fergus (Freeland), vision and work . . . 260

Gillies (Major H. D.), introduction to discussion on plastic operations of the eyelids 70
Giri (D. V.), bilateral superficial symmetrical opacities of the cornea of unknown origin 147
——— discussion on contagious diseases of the conjunctiva . 67
Glare glasses, note on the use of (G. McPherson) . . 282

PAGE
Glaucoma operations, histology of the trephined disc in (R. H. Elliot) 227
——— statistics of (T. Harrison Butler) . . . 368

Hanson (Staff-Surgeon R. J. E.), ophthalmology and the war 322
Hartridge (G.), conditions affecting the standard of vision in the British Army 141
Hay (Capt. Percival J.), ophthalmology and the war . . 317
Hemianopsia, case of double homonymous lateral (J. Gray Clegg) 182
——— monocular traumatic altitudinal (J. Gray Clegg) . 179
Henderson (Capt. Thomas), discussion on dioptric mean in myopia 259
——— ——— histology of the trephined disc in glaucoma . 244
——— ——— effects of hypotony in rabbits' eyes . . 226
——— "suture" operation for contracted socket and allied conditions 119
Hepburn (M. L.), papilloma of the conjunctiva . . 124
Herpes zoster affecting the ciliary tract (G. W. Thompson) . 152
——— ophthalmicus, some observations on (Lt.-Col. R. H. Elliot) 351
Higgins (C.), discussion on plastic operations of the eyelids . 100
Hine (Capt. M. L.), discussion on contagious diseases of the conjunctiva 53
Histology of the trephined disc in glaucoma operations (R. H. Elliot) 227
Hosford (Stroud), discussion on the histology of the trephined disc in glaucoma 248
——— peripapillary swelling, ? angioma . . . 158
——— ring-sarcoma of optic papilla (endothelial sarcoma) . 160
Hudson (A. C.), large perimeter with eccentric system of registration 213
Hypotony, effects of, in rabbits' eyes (E. Treacher Collins) . 217

Intra-ocular tension 217

Lantern-slides, regulations for the loan of . . xxxvii
Library Rules xxxvi
Light and colour, suggested clinical tests of the threshold of (George Young) 279
Lister (Col. W. T.), discussion on contagious diseases of the conjunctiva 52

PAGE

MacCallan (A. F.), discussion on contagious diseases of the conjunctiva 54
Mackay (George), discussion on a perimeter with eccentric system of registration 215
——— ——— the effects of hypotony in rabbits' eyes . 226
McKee (S. Hanford), some aspects of military ophthalmology 324
McPherson (G.), note on the use of glare glasses . . 282
Mayou (M. S.), case of sympathetic paralysis associated with cervical rib 178
——— congenital anterior synechiæ, with buphthalmos and pupillary membrane 146
——— corneal degeneration 148
——— discussion on case of cryptophthalmos . . 144
——— ——— contagious diseases of the conjunctiva . 61
——— ——— herpes zoster affecting the ciliary tract . 156
——— ——— plastic operations of the eyelids . . 114
——— ——— the effects of hypotony in rabbits' eyes . 226
——— purulent ring infiltration of the cornea following "mustard gas" 149
Midland Ophthalmological Society Reports . . . 363
Military ophthalmia in Egypt (H. L. Eason) . . . 30
——— ophthalmology, some aspects of (S. Hanford McKee) . 324
Museum, list of exhibits 285
"Mustard gas," purulent ring infiltration of the cornea following (M. S. Mayou) 149
Myopia, dioptric mean in, with reference to military requirements (W. Wallace) 254
Myotonia atrophica, case of, with family history of cataract (Dr. Kinnier Wilson) 183

Nervous system, central, diseases of, associated with ocular conditions 168
Nettleship prize xxxviii
——— winners iii

Ocular conditions, and diseases of the central nervous system . 168
——— muscles, paralysis of (James Taylor) . . 168
Officers and Council . . . .
Operations, plastic, of the eyelids, discussion on . . 70
Ophthalmia, contagious, discussion on . . . 9
——— ——— resolution relating to . . . 68
——— military, in Egypt (H. L. Eason) . . . 30
——— school, historical note on (S. Stephenson) . . 11

PAGE
Ophthalmological societies, affiliation of . . . 286
Ophthalmology and the war: Doyne Memorial Lecture (Sir William Collins) 292
——— military, some aspects of (S. Hanford McKee) . 324
Optic nerve and retina, diseases of the . . . 165
Ormond (Major A. W.), discussion on plastic operations of the eyelids 112
Oxford Ophthalmological Congress, 1918, Reports . . 289
——— ——— history of the (Sydney Stephenson) . . 289

Papilloma of the conjunctiva (M. L. Hepburn) . . 124
Papillœdema and allied conditions . . . 170
——— in cerebral tumour (Leslie Paton) . . . 170
Paralysis of ocular muscles (James Taylor) . . . 168
——— sympathetic, associated with cervical rib (M. S. Mayou) 178
Parsons (Col. J. H.), discussion on cases of botulism . 177
Paterson (J. V.), conditions affecting the standard of vision in the British Army 138
Paton (Leslie), cases of papillœdema in cerebral tumour . 170
——— discussion on case of myotonia atrophica . . 183
——— ——— cases of botulism 173
——— ——— epibulbar sarcoma cured by removal and radium 127
Perimeter, large, with eccentric method of registration (A. C. Hudson) 213
Perimeters and perimetric observations . . . 185
Peripapillary swelling, ? angioma (Stroud Hosford) . . 158
Plastic operations of the eyelids, discussion on, introduced by Major H. D. Gillies, 70; C. Higgins, 100; Capt. Derwent Wood, 102; T. Harrison Butler, 107; Major A. W. Ormond, 112; M. S. Mayou, 114; Capt. R. R. Cruise, 114; J. Gray Clegg, 115; Major Gillies' reply, 116.
Presidential address (E. Treacher Collins) . . . 1
Presidents of the Society ii
Purchas (Major A. C.), ophthalmology and the war . . 322

Rabbits' eyes, effects of hypotony in (E. Treacher Collins) . 217
Radium, case of epibulbar sarcoma cured by removal and (E. Treacher Collins) 125
Report of the committee on the conditions affecting the standard of vision in the British Army; also a communication from Messrs. Traquair and Paterson on the same subject 130
Retina and optic nerve, diseases of the . . . 165

PAGE
Retina, bilateral angiomata of the (E. Treacher Collins) . 165
Ring-sarcoma of the optic papilla (endothelial sarcoma) (Stroud Hosford) 100
Rules of the Society xxxiv

Sarcoma, endothelial (Stroud Hosford) . . . 160
——— epibulbar, case of, cured by removal and radium (E. Treacher Collins) 125
Scotometer, new form of (R. H. Elliot) . . . 185
Seidel's sign 189
Sinclair (W.), case of cryptophthalmos . . . 142
——— discussion on clinical tests of the threshold of light and colour 281
Snowball (T.), discussion on case of cryptophthalmos . 145
Socket, contracted, suture operation for (Thomson Henderson) 119
Stack (Capt. E. H.), discussion on dioptric mean in myopia . 260
——— ——— suture operation for contracted socket . 122
——— on ophthalmology and the war . . . 314
Standard of vision in the British Army, report of the committee on the conditions affecting the . . . 130
Stephenson (S.), discussion on contagious diseases of the conjunctiva 11
——— opening address at the Oxford Ophthalmological Congress, 1918 289
Story (J. B.), discussion on contagious diseases of the conjunctiva 9, 63, 68
——— ——— epibulbar sarcoma cured by removal and radium 128
——— ——— monocular traumatic altitudinal hemianopsia . 182
——— ——— suture operation for contracted socket . 122
——— introduction to a discussion on contagious diseases of the conjunctiva (contagious ophthalmia) . . 9
Suture operation for contracted socket (Thomson Henderson) . 119
Synechiæ, congenital anterior, with buphthalmos and pupillary membrane (M. S. Mayou) 146

Taylor (James), paralysis of ocular muscles . . 168
Thompson (G. W.), cases of herpes zoster affecting the ciliary nerves 152
Trachoma, natural history of (E. Treacher Collins) . . 47
Traquair (H. M.), conditions affecting the standard of vision in the British Army 138
Trustees of the Society iii
Tumour, cerebral, papilloedema in (Leslie Paton) . . 170

PAGE

Tyrrell (F. A. C.), discussion on contagious diseases of the conjunctiva 59

Ulcus serpens of the cornea, treatment of (A. B. Cridland) . 363
Uveal tract, diseases of the 152

Vision and work (Freeland Fergus) . . . 260
Vision, standard of, in the British Army: report of the Committee on the conditions affecting it . . . 130
Visor, a further note on the (Capt. R. R. Cruise) . . 250

Wallace (Capt. W.), dioptric mean in myopia, with special reference to military requirements . . . 254
——— discussion on clinical tests of the threshold of light and colour 282
War, ophthalmology and the: Doyne Memorial Lecture (Sir William Collins) 292
Wharton (J.), discussion on contagious diseases of the conjunctiva 18
Whittington (Capt. T. H.), ophthalmology and the war . 323
Wilson (Dr. Kinnier), case of myotonia atrophica, with family history of cataract 183
——— discussion on cases of botulism . . . 176
——— ——— sympathetic paralysis associated with cervical rib 178
Wood (Capt. Derwent), discussion on plastic operations of the eyelids 102
Work, vision and (Freeland Fergus) . . . 260

Young (George), discussion on a new form of scotometer . 211
——— ——— the effects of hypotony in rabbits' eyes . 225
——— ophthalmology and the war . . . 323
——— suggested clinical tests of the threshold of light and colour 279

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